USER MANUAL

ATU-R110

ADSL Ethernet Router

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1 Introduction

Congratulations on becoming the owner of the ATU-R110 ADSL Ethernet bridge/router. Your LAN (local area network) will now be able to access the Internet using your high-speed ADSL connection.

This User Guide will show you how to install and set up your ATU-R110 ADSL Bridge/Router.

Features

- Internal ADSL modem for high-speed Internet access
- 10/100Base-T/Tx Ethernet router to provide Internet connectivity to all computers on your LAN
- Network address translation (NAT) and IP filtering functions to provide firewall protection for your computers
- Network configuration through DHCP
- Configuration program you access via an HTML browser
- Menu-driven configuration tool via RS232C interface.

System Requirements

In order to use your ATU-R110 ADSL/Ethernet router, you must have the following:

- ADSL service up and running on your telephone line, with at least one public Internet address for your LAN
- One or more computers each containing an Ethernet 10Base-T/100Base-Tx network interface card (NIC).
- An Ethernet hub/switch, if you are connecting the device to more than one computer
- For system configuration using the supplied web-based program: a web browser such as Internet Explorer v5.0 or later, or Netscape v4.7 or later
- For system configuration using the supplied menu-driven configuration tool: a RS232C interface and terminal emulation program is required.

Using this Document

Notational conventions

- Acronyms are defined the first time they appear in text and in the glossary (Appendix D).
- For brevity, the ATU-R110 is referred to as ¡§the devi cq¨
- The terms *LAN* and *network* are used interchangeably to refer to a group of Ethernet-connected computers at one site.

Typographical conventions

- *Italics* are used to identify terms that are defined in the glossary (Appendix D).
- **Bolded** text is used for items you select from menus and drop-down lists, and to identify field labels you view on-screen.

Special messages

This document uses the following icons to call your attention to specific instructions or explanations.

Note

Definition

WARNING

2 Getting to Know the ATU-R110

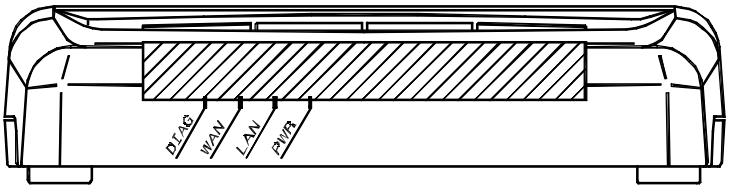
Parts Check

In addition to this document, your ATU-R110should arrive with the following:

- One ATU-R110 ADSL Ethernet Bridge/Router
- One power adapter and power cord
- One cross-over Ethernet cable
- Two RJ-11 to RJ-11 telephone cables

Front Panel

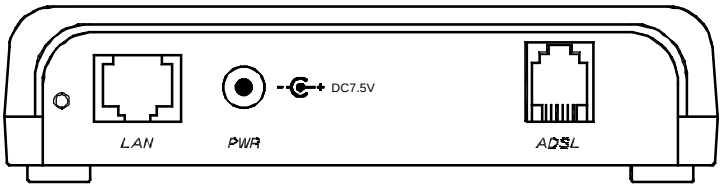
The front panel contains lights called LEDs that indicate the status of the unit.



Label	Color	Function
DIAG	yellow	Flashes on/off at boot-up to indicate that the device software is operational.
WAN	green	Flashes on/off during the training mode and data transfer. On: ADSL link established and active
LAN	green	On: LAN link established and active Off: No LAN link Flashes during data transfer
PWR	green	On: Unit is powered on Off: Unit is powered off

Rear Panel

The rear panel contains the ports for the unit's data and power connections.



Label	Function
ADSL	Connects the device to a telephone jack using the supplied cable
On/Off	Switches the unit on and off
Power	Connects to the supplied power converter cable
Ethernet	Connects the device to your PC's Ethernet port, or to the uplink port on your LAN's hub, using the cable provided

3 Quick Start

This Quick Start provides basic instructions for connecting the ATU-R110to a computer or LAN and to the Internet.

- Part 1 describes setting up the hardware.
- Part 2 describes how to configure your computer(s) to work with the ATU-R110.
- Part 3 describes the default configuration, and refers you to the appropriate chapter for instructions on modifying the defaults.

This Quick Start assumes that you have already established ADSL service with your Internet service provider (ISP). These instructions provide a basic configuration that should be compatible with your home or small office network setup. Refer to the subsequent chapters for additional configuration instructions.

Part 1 ¡ Connecting the Hardware

In Part 1, you connect the device to the phone jack, the power outlet, and your computer or network.

WARNING

Figure 1 illustrates the hardware connections. The layout of the ports on your device may vary from the layout shown. Refer to the steps that follow for specific instructions.

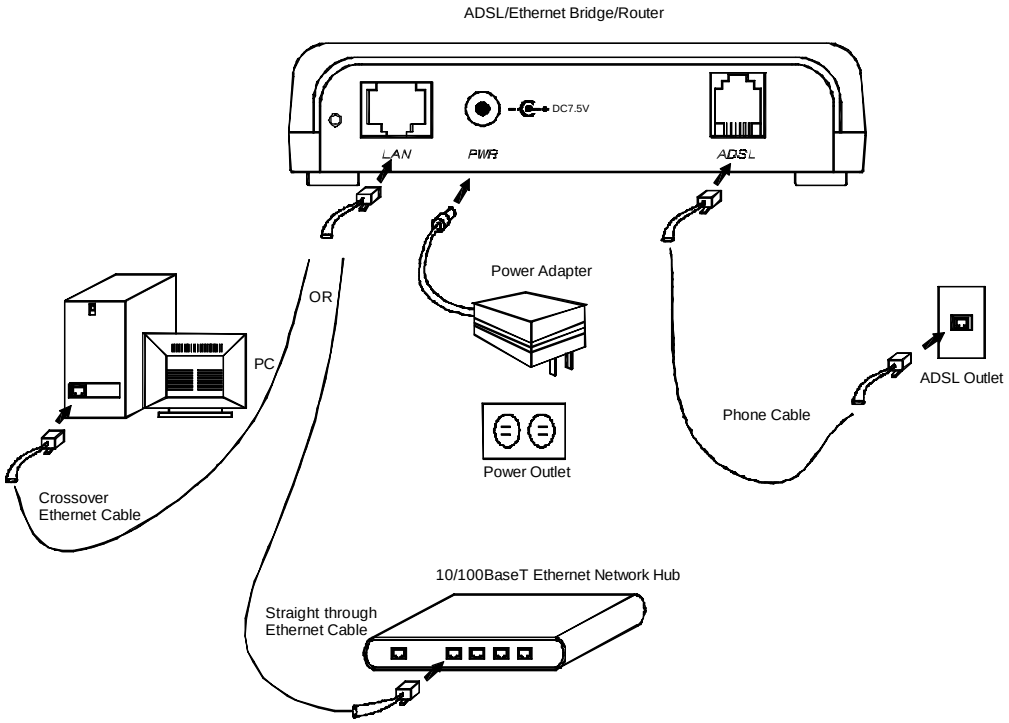


Figure 1. Overview of Hardware Connections

Step 1. Connect the ADSL cable and optional telephone.

Connect one end of the provided phone cable to the port labeled ADSL on the rear panel of the device. Connect the other end to your wall phone jack.

You can attach a telephone line to the device. This is helpful when the ADSL line uses the only convenient wall phone jack. If desired, connect the telephone cable to the port labeled PHONE.

WARNING

Step 2. Connect the Ethernet cable.

If you are connecting a LAN to the ATU-R110 ADSL/Ethernet router, attach one end of a provided Ethernet cable to a regular hub port and the other to the Ethernet port on the ATU-R110.

If you are using the ATU-R110 with a single computer and no hub, you must use a ¡§crossover¡¨ Ethernet cable (not provided) to attach the PC directly to the device. The crossover cable is wired differently than the cable you would use to connect to a hub. When you compare the colored wires on each end of a straight-through cable, they will be in the same sequence; on crossover cables, they will not. Contact your ISP for assistance.

Step 3. Attach the power connector.

Connect the AC power adapter to the PWR connector on the back of the device and plug in the adapter to a wall outlet or power strip.

Step 4. Turn on the ATU-R110 and power up your systems.

Press the Power switch on the back panel of the device to the ON position.

Turn on and boot up your computer(s) and any LAN devices such as hubs or switches.

Part 2 ¡ Configuring Your Computers

Part 2 of the Quick Start provides instructions for configuring the Internet settings on your computers to work with the ATU-R110.

Before you begin

By default, the ATU-R110 automatically assigns all required Internet settings to your PCs. You need only to configure the PCs to accept the information when it is assigned.

Note

In some cases, you may want to assign Internet information manually to some or all of your computers rather than allow the ATU-R110 to do so. See ¡Assigning static Internet information to your PCs¡¨ on page20 for instructions.

These instructions assume that your PCs are already connected to a LAN through their network interface cards (NICs) and the appropriate Ethernet adapter software.

Follow the instructions that correspond to the operating system installed on each PC.

Setting the LAN IP Address

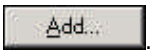
Windows„ 95, 98 PCs:

First, check for the IP protocol and, if necessary, install it:

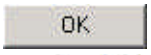
1. In the Windows task bar, click the Start button, point to **Settings**, and then click **Control Panel**.
2. Double-click the Network icon.

   The Network dialog box displays with a list of currently installed network components. If the list includes TCP/IP, and then the protocol has already been enabled. Skip to step 9.
3. If TCP/IP does not display as an installed component, click

.

   The Select Network Component Type dialog box displays.
4. Select **Protocol**, and then click 

.

   The Select Network Protocol dialog box displays.
5. Click on **Microsoft** in the Manufacturers list box, and then click **TCP/IP** in the Network Protocols list box.
6. Click 

to return to the Network dialog box, and then click

again.

   You may be prompted to install files from your Windows 95/98 installation CD. Follow the instructions to install the files.

7. Click OK to restart the PC and complete the TCP/IP installation.

Next, configure the PCs to accept IP information assigned by the ATU-R110:

8. Open the Control Panel window, and then click the Network icon.
9. Select the network component labeled TCP/IP, and then click Properties.

   If you have multiple TCP/IP listings, select the listing associated with your network card or adapter.
10. In the TCP/IP Properties dialog box, click the IP Address tab.
11. Click the radio button labeled **Obtain an IP address automatically**.
12. Click the DNS Configuration tab, and then click the radio button labeled **Obtain an IP address automatically**.
13. Click OK twice to confirm and save your changes.

    You will be prompted to restart Windows.
14. Click Yes.

Windows NT 4.0 workstations:

First, check for the IP protocol and, if necessary, install it:

1. In the Windows NT task bar, click the Start button, point to **Settings**, and then click **Control Panel**.
2. In the Control Panel window, double click the Network icon.
3. In the Network dialog box, click the Protocols tab.

   The Protocols tab displays a list of currently installed network protocols. If the list includes TCP/IP, then the protocol has already been enabled. Skip to step 9.
4. If TCP/IP does not display as an installed component, click Add...
5. In the Select Network Protocol dialog box, select **TCP/IP**, and then click OK.

   You may be prompted to install files from your Windows NT installation CD or other media. Follow the instructions to install the files.

   After all files are installed, a window displays to inform you that a TCP/IP service called DHCP can be set up to dynamically assign IP information.
6. Click Yes to continue, and then click OK if prompted to restart your computer.

Next, configure the PCs to accept IP information assigned by the ATU-R110:

7. Open the Control Panel window, and then double-click the Network icon.
8. In the Network dialog box, click the Protocols tab.
9. In the Protocols tab, select **TCP/IP**, and then click Properties.
10. In the Microsoft TCP/IP Properties dialog box, click the radio button labeled **Obtain an IP address from a DHCP server**.
11. Click OK twice to confirm and save your changes, and then close the Control Panel.

Windows 2000/XP PCs:

First, check for the IP protocol and, if necessary, install it:

1. In the Windows task bar, click the Start button, point to **Settings**, and then click **Control Panel**.
2. Double-click the Network and Dial-up Connections icon.
3. In the Network and Dial-up Connections window, right-click the Local Area Connection icon, and then select **Properties**.

   The Local Area Connection Properties dialog box displays with a list of currently installed network components. If the list includes Internet Protocol (TCP/IP), then the protocol has already been enabled. Skip to step 10.
4. If Internet Protocol (TCP/IP) does not display as an installed component, click Install...
5. In the Select Network Component Type dialog box, select **Protocol**, and then click Add...
6. Select **Internet Protocol (TCP/IP)** in the Network Protocols list, and then click OK.

   You may be prompted to install files from your Windows 2000/XP installation CD or other media. Follow the instructions to install the files.
7. If prompted, click OK to restart your computer with the new settings.

Next, configure the PCs to accept IP information assigned by the ATU-R110:

8. In the Control Panel, double-click the Network and Dial-up Connections icon.
9. In Network and Dial-up Connections window, right-click the Local Area Connection icon, and then select **Properties**.

10. In the Local Area Connection Properties dialog box, select **Internet Protocol (TCP/IP)**, and then click Properties.
11. In the Internet Protocol (TCP/IP) Properties dialog box, click the radio button labeled **Obtain an IP address automatically**. Also click the radio button labeled **Obtain DNS server address automatically**.
12. Click OK twice to confirm and save your changes, and then close the Control Panel.

Windows Me PCs

1. In the Windows task bar, click the Start button, point to **Settings**, and then click **Control Panel**.
2. Double-click the Network and Dial-up Connections icon.
3. In the Network and Dial-up Connections window, right-click the Network icon, and then select **Properties**.

   The Network Properties dialog box displays with a list of currently installed network components. If the list includes Internet Protocol (TCP/IP), then the protocol has already been enabled. Skip to step 11.
4. If Internet Protocol (TCP/IP) does not display as an installed component, click Add...
5. In the Select Network Component Type dialog box, select **Protocol**, and then click Add...
6. Select **Microsoft** in the Manufacturers box.
7. Select **Internet Protocol (TCP/IP)** in the Network Protocols list, and then click OK.

   You may be prompted to install files from your Windows Me installation CD or other media. Follow the instructions to install the files.
8. If prompted, click OK to restart your computer with the new settings.

Next, configure the PCs to accept IP information assigned by the ATU-R110:

9. In the Control Panel, double-click the Network and Dial-up Connections icon.
10. In Network and Dial-up Connections window, right-click the Network icon, and then select **Properties**.
11. In the Network Properties dialog box, select **TCP/IP**, and then click Properties.
12. In the TCP/IP Settings dialog box, click the radio button labeled **Server assigned IP address**. Also click the radio button labeled **Server assigned name server address**.

13. Click OK twice to confirm and save your changes, and then close the Control Panel.

Assigning static Internet information to your PCs

In some cases, you may want to assign Internet information to some or all of your PCs directly (often called "statically"), rather than allowing the ATU-R110 to assign it. This option may be desirable (but not required) if:

- You have obtained one or more public IP addresses that you want to always associate with specific computers (for example, if you are using a computer as a public web server).
- You maintain different subnets on your LAN (subnets are described in Appendix 0).

Before you begin, contact your ISP if you do not already have the following information:

- The IP address and subnet mask to be assigned to each PC to which you will be assigning static IP information.
- The IP address of the default gateway for your LAN. In most cases, this is the address assigned to the LAN port on the ATU-R110. By default, the LAN port is assigned this IP address: **192.168.1.1**. (You can change this number, or another number can be assigned by your ISP. See Chapter 5 for more information.)
- The IP address of your ISP's Domain Name System (DNS) server.

On each PC to which you want to assign static information, follow the instructions on pages 16 through 19 relating only to checking for and/or installing the IP protocol. Once it is installed, continue to follow the instructions for displaying each of the Internet Protocol (TCP/IP) properties. Instead of enabling dynamic assignment of the IP addresses for the computer, DNS server, and default gateway, click the radio buttons that enable you to enter the information manually.

Note

Your PCs must have IP addresses that place them in the same subnet as the ATU-R110's LAN port. If you manually assign IP information to all your LAN PCs, you can follow the instructions in Chapter 5 to change the LAN port IP address accordingly.

Part 3 ¡ Configuring the ATU-R110

In Part 3, you log into the program on the ATU-R110 and configure basic settings for your Internet connection. Your ISP should provide you with the necessary information to complete this step.

Operation Mode

- **Enable?** This setting enables or disables the ATU-R110. When set to ¡§No¡¨, the device cannot be used to provid Internet connectivity for your network. Set it to ¡§Yes¡¨ now/i necessary.
- **Encapsulation:** This setting determines the type of data link used to communicate with your ISP: LLC muxed or VC.
- **Bridge:** This setting enables or disables bridging between the ATU-R110 and your ISP. Your ISPs may also refer to this using ¡§RFC1483¡¨ or ¡§Ethernet over AT
- **IGMP:** This setting enables or disables the Internet Group Management Protocol, which some ISPs use to perform remote configuration of your device.
- **IP Address** and **Subnet Mask:** If your ISP has assigned a public IP address to your Network, enter the address and the associated subnet mask in the boxes provided.
- **WAN Gateway**. Enter the gateway IP address for your ISP¡¦s network

DNS Settings

- **DNS Proxy Selection:** This setting determines how the ATU-R110 will obtain DNS server addresses. The DNS server matches the user-friendly website names you type into your browser with the sites¡¦ numerical IP addresses Choose User Configured if you know the DNS server addresses; otherwise choose AutoDiscovery.
- **Primary/Secondary DNS:** If you selected *User Configured* in the DNS Proxy Selection, enter the Primary and Secondary DNS addresses provided by your ISP. If you selected *Auto Discovery + User Configured*, you are not required to enter addresses here; they will be used in addition to any addresses discovered automatically.

PPP Settings

- **Username** and **Password:** Enter the username and password you use to log in to your ISP.
- **Disconnect timeout:** Enter the number of seconds after which your ISP connection will time out if there is no activity.
- **Authentication:** Select the user/password authentication method your ISP uses (PAP or CHAP).

Default Router Settings

In addition to handling the DSL connection to your ISP, the ATU-R110 ADSL/Ethernet router can provide a variety of services to your network. The device is preconfigured with default settings for use with a typical home or small office network.

Table 1 lists some of the most important default settings; these and other features are described fully in the subsequent chapters. If you are familiar with network configuration, review the settings in Table 1 to verify that they meet the needs of your network. Follow the instructions to change them if necessary. If you are unfamiliar with these settings, try using the device without modification, or contact your ISP for assistance.

Before you modifying any settings, review Chapter 4 for general information about accessing and using the Configuration Manager program. We strongly recommend that you contact your ISP prior to changing the default configuration.

Table 1. Default Settings Summary

Option	Default Setting	Explanation/Instructions
DHCP (Dynamic Host Configuration Protocol)	DHCP server enabled with two pools of addresses: For LAN computers: 192.168.1.2 through 192.168.1.13 For USB computer: 192.168.2.2 (for both, subnet mask = 255.255.255.0)	The ATU-R110 maintains a pool of 12 private IP addresses for dynamic assignment to your LAN computers and a pool containing 1 IP address for assignment to your USB computer . To use this service, you must have set up your computers to accept IP information dynamically, as described in Part 2 of the Quick Start. See Chapter 7 for an explanation of the DHCP service.
NAT (Network Address Translation)	napt rule enabled	Your computers¡¦ private IP addresses (see DHCP above) will be translated to your public IP address whenever they access the Internet. See Chapter 8 for a description of the NAT service.
LAN Port IP Address	Static IP address: 192.168.1.1 subnet mask: 255.255.255.0	This is the IP address of the LAN port on the device. The LAN port connects the device to your Ethernet network. Typically, you will not need to change this address. See Chapter 5 for instructions.
USB Port IP Address	Disable	No used.

Testing Your Setup

The Quick Start process you just completed should enable any computer on your LAN to use the ATU-R110's ADSL connection to access the Internet.

To test the connection, turn on the device, wait about 30 seconds, and then verify that its LEDs are illuminated as shown in Table 2.

Table 2. LED Indicators

This LED:	...should be:
DIAG	Flashing on/off while the device is booting.
WAN	Solid green to indicate that the device has successfully established a connection with your ISP. Flashes during data transfer.
LAN	Solid green to indicate that the device can communicate with your LAN. Flashes during data transfer.
PWR	Solid green to indicate that the device is turned on. If this light is not on, check the power cable attachment.

If the LEDs illuminate as expected, test your Internet connection from a LAN computer (and from the USB computer, if applicable): Open your web browser, and type the URL of any external website (such as *http://www.yahoo.com*). The LED labeled WAN ACT should be blinking rapidly and may appear solid as the device connects to the site.

If the LEDs do not illuminate as expected or the web page does not display:

- Ensure that the default settings shown on page 22 are appropriate for your network setup.
- See Appendix "Troubleshooting" for tips on correcting a variety of common problems.
- Contact your ISP customer support for assistance.

4 Getting Started with the Configuration Manager

Your ATU-R110 includes preinstalled software program called the *Configuration Manager*, which you can use to view performance data and change how the device operates. This chapter describes how to use the Configuration Manager.

Accessing the Configuration Manager

The Configuration Manager program is preinstalled into memory on the ATU-R110. To access the program, you need the following:

- A PC or laptop connected to the LAN port on the device as described in the Quick Start chapter.
- An web browser installed on the PC. The program is designed to work best with Microsoft Internet ExplorerR version 5.0, Netscape NavigatorR version 4.7, or later versions.

You can access the program from any computer connected to the ATU-R110 via the LAN ports.

1. From a LAN computer, open your web browser, type the following URL in the web address (or location) box, and press **<Enter>**:

   `http://192.168.1.1`

   These are the predefined IP addresses for the LAN ports on the ATU-R110.

   A login screen displays, as shown in Figure 2.

Figure 2. Login Screen

2. Enter your user name and password, and then click OK.
3. The first time you log into the program, use these defaults:

Default User Name: root
Default Password: root

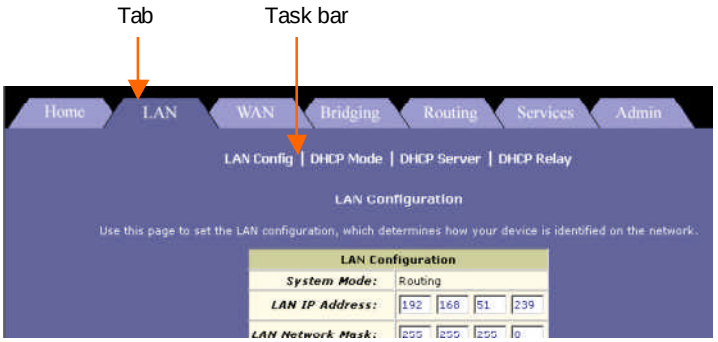
Note

You can change the password at any time (see Changing Your Login Password on page 22). The user name cannot be changed.

The System View page displays each time you log into the program (shown in Figure 3 on page 27).

Functional Layout

Configuration Manager tasks are grouped into categories, which you can access by clicking the tabs at the top of each page. Each tab, except for the Home tab which displays when you first log in, displays the available tasks horizontally the top of the page. You can click on these to display the specific configuration options.



A separate page displays for each task in the task bar. The left-most task displays by default when you click on a new tab. The same task may appear in more than one tab, when appropriate. For example, the LAN Config task displays in both the LAN tab and the Routing tab.

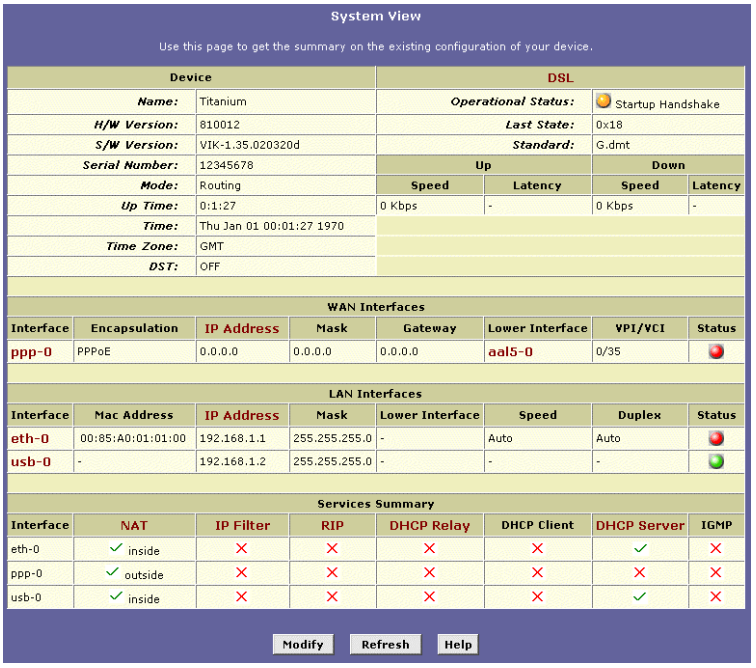
Commonly used buttons

The following buttons are used throughout the application.

Button	*Function*
Submit	Stores in *temporary* system memory any changes you have made on the current page. See ¡ Committing your changes¡¨ on page32 for instructions on storing changes permanently.
Refresh	Redisplays the current page with updated statistics.
Clear	When accumulated statistics are displaying, this button resets the statistics to their initial values.
Help	Launches the online help for the current topic in a separate browser window. Help is available from any main topic page.

The Home Tab and System View Table

The Home Tab displays when you first access the program: Only one topic page ¡ the System View page ¡ is available on the Home tab.



System View

Use this page to get the summary on the existing configuration of your device.

Device		DSL			
Name:	Titanium	Operational Status:	Startup Handshake		
H/W Version:	810012	Last State:	0x18		
S/W Version:	VIK-1.35.020320d	Standard:	G.dmt		
Serial Number:	12345678	Up		Down	
Mode:	Routing	Speed	Latency	Speed	Latency
Up Time:	0:1:27	0 Kbps	-	0 Kbps	-
Time:	Thu Jan 01 00:01:27 1970				
Time Zone:	GMT				
DST:	OFF				

WAN Interfaces

Interface	Encapsulation	IP Address	Mask	Gateway	Lower Interface	VPI/VCI	Status
ppp-0	PPPoE	0.0.0.0	0.0.0.0	0.0.0.0	aal5-0	0/35	

LAN Interfaces

Interface	Mac Address	IP Address	Mask	Lower Interface	Speed	Duplex	Status
eth-0	00:85:A0:01:01:00	192.168.1.1	255.255.255.0	-	Auto	Auto	
usb-0	-	192.168.1.2	255.255.255.0	-	-	-	

Services Summary

Interface	NAT	IP Filter	RIP	DHCP Relay	DHCP Client	DHCP Server	IGMP
eth-0	✓ inside	✗	✗	✗	✗	✓	✗
ppp-0	✓ outside	✗	✗	✗	✗	✗	✗
usb-0	✓ inside	✗	✗	✗	✗	✓	✗

Modify Refresh Help

Figure 3. System View Page

The System View table provides a snapshot of your system configuration, and provides links to the software pages that enable you to configure each setting (if available). The following table describes the various sections of the system view table.

Table Heading	Description
Device	Displays basic information about the ATU-R110 hardware and software versions, the system uptime (since the last reboot), and the preconfigured operating mode.
DSL	Displays performance statistics for the DSL line. You can click the **DSL** link in the Advanced title bar to display additional DSL settings, which are described in Chapter 14.
WAN Interfaces	Displays the software name(s) and various settings for the device interfaces that communicate with your ISP via DSL. Although you only have one physical DSL port, multiple software-defined interfaces can be configured to use it. See the ATM VCC, PPP, EOA, and IPoA chapters (Chapters 12, 13, 14, and 15, respectively) for more information about the interfaces defined on you system.

Table Heading	Description
LAN Interfaces	Displays the software names and various settings for the device interfaces that communicate directly with your network. These typically include at least one Ethernet interface, named *eth-0*, and may include a USB interface named *usb-0*. You can configure some properties of these interfaces, as described in Chapter 5.
Services Summary	Displays the following service that the ATU-R110 performs to help you manage your network: o Translating private IP addresses to your public IP address (NAT, Chapter 8). o Setting up filtering rules that accept or deny incoming or outgoing data. (IP Filter, Chapter 16). o Enabling router-to-router communication (RIP, Chapter 9). o Dynamic assignment or receipt of IP information (DHCP, Chapter 7). o Message forwarding based on Internet Group assignment (IGMP, not configurable).

Changing the System Date and Time

The device keeps a record of the current date and time, which it uses to calculate and report various performance data.

Note

Changing the ATU-R110 date and time does not affect the date and time on your PCs.

Follow these instructions to change the date and time:

1. At the bottom of the System View page, click Modify.

   The System ¡ Modify page displays in a separate browser window:

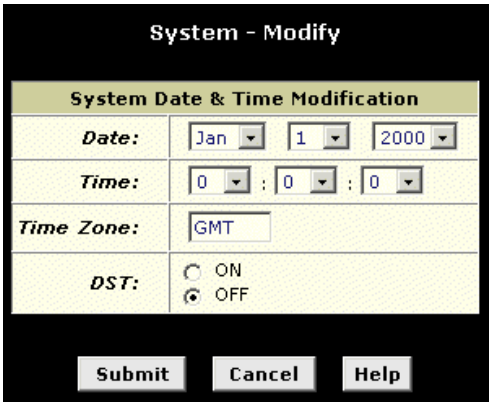


   Figure 4. System ¡ Modify Page

2. Use the drop-down lists to select a new date and time.
3. Click Submit.

   A page displays to confirm your change.

4. Click Close to return to the System View page.
5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
6. Click Commit to save your changes to permanent memory.

Changing Your Login Password

The first time you log into the Configuration Manager, you use the default user ID and password (*root* and *root*). The system allows only one user ID and password. Only the password can be changed.

Note

This user ID and password is only used for logging into the Configuration Manager; it is not the same as the login you may use to connect to your ISP (described in Chapter 12).

To change the Configuration Manager login password:

1. Click the Admin tab.

   The User Password Configuration page displays by default.

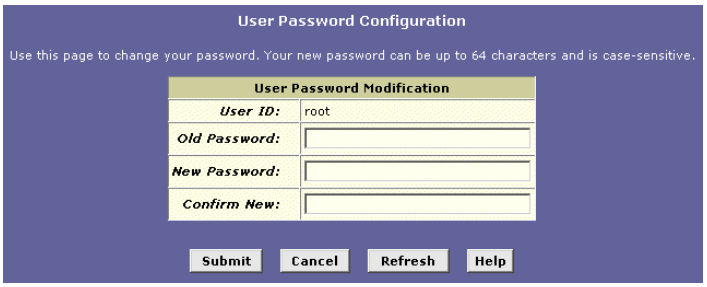


Figure 5. User Password Configuration Page

2. Type your current password in the Old Password text box.
3. Type the new password in the New Password text box and again in the Confirm New text box.

   The password can be up to eight ASCII characters long. When logging in, you must type the new password in the same upper and lower case characters that you use here.

4. Click Submit.
5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
6. Click Commit to save your changes to permanent memory.

Committing Your Changes and Rebooting the Device

Committing your changes

Whenever you use the Configuration Manager to change system settings, the changes are initially placed in temporary storage (called random access memory or RAM). Your changes are made effective when you submit them, but will be lost if the device is reset or turned off.

To save your changes for future use, you can use the commit function. This function saves your changes from RAM to permanent storage (called flash memory).

Note

***Submitting** changes saves them only until the device is reset or powered down. **Committing** changes saves them permanently.*

Follow these steps to commit changes to permanent storage.

1. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

   The Commit & Reboot page displays:

   Figure 6. Commit & Reboot Page

2. Click Commit. (Disregard the selection in the Reboot Mode drop-down list; it does not affect the commit process.)

   The changes are saved to permanent storage.

   The previous settings are copied to backup storage so that they can be recalled if your new settings do not work properly (see the rebooting instructions on page 33).

Rebooting the device using Configuration Manager

To reboot the device, display the Commit and Reboot page, select the appropriate reboot mode from the drop-down menu, and then click Reboot.

You can select from the following three options when rebooting:

Option	Description
Reboot from Last Configuration	Reboots the device using the current settings in permanent memory, including any changes you just committed.
Reboot from Backup Configuration	Reboots the device using settings stored in backup memory. These are the settings that were in effect before you committed new settings in the current session.
Reboot from Default Configuration	Reboots the device to default settings provided by your ISP or the manufacturer. Choosing this option erases any custom settings.

WARNING

5 Setting the LAN IP Address

This chapter describes how to configure the interfaces on the ADSL/Ethernet router that communicate with your LAN computers.

Ethernet

If you are using the ADSL/Ethernet router with multiple PCs on your LAN, you must connect the LAN via an Ethernet hub to the device's LAN port, called eth-0.

If you are using a single PC with the ADSL/Ethernet router, you have two options for connecting it to the device:

- You can connect the PC directly to the LAN port using a crossover Ethernet cable. See Appendix C, "Troubleshooting" for a description of crossover versus straight-through Ethernet cables.

You must assign a unique IP address to each device port that you use.

Note

The instructions that follow assume that the device has been preconfigured to operate in Routing mode, which uses the IP protocol to determine how to exchange data among your PCs, the device, and your ISP. If your device is configured in Bridging mode, its ports do not require IP addresses. The operating mode displays at the top of the LAN Configuration page and cannot be changed by the user.

Configuring the LAN IP Address

The LAN IP address identifies the LAN port (eth-0) as a node on your network; that is, its IP address must be in the same subnet as the PCs on your LAN.

Definition

*A **network node** can be thought of as any interface where a device connects to the network, such as the ATU-R110's LAN port and the network interface cards on your PCs. See Appendix 0 for an explanation of subnets..*

You can change the default to reflect the set of IP addresses that you want to use with your network.

If your network uses a local DHCP server (other than the ADSL/Ethernet router) to assign IP addresses, you can configure the device to accept and use a LAN IP address assigned by that server. In this mode, the ADSL/Ethernet router is considered a *DHCP client* of your DHCP server.

Note

*The ATU-R110 itself can function as a DHCP server for your LAN computers, as described in Chapter 5, **but not for its own LAN port**.*

Follow these steps to change the default LAN IP address or to configure the LAN port as a DHCP client.

1. Log into Configuration Manager, and then click the LAN tab.

   The LAN Configuration page displays, as shown in Figure 7.

Figure 7. LAN Configuration Page

The LAN Configuration table displays the following settings:

System Mode	The preconfigured mode for your device, such as Routing or Bridging mode. This setting is not user - configurable.
LAN IP Address	The IP address your computers use to identify the device¡¦s LAN port. Note that the public IP address assigned to you by your ISP **is not** your LAN IP address. The public IP address identifies the WAN (ADSL) port on your ADSL/Ethernet router to the Internet.
LAN Network Mask	The LAN Network mask identifies which parts of the LAN IP Address refer to your network as a whole and which parts refer specifically to nodes on the network. Your device is preconfigured with a default network mask of 255.255.255.0.
Use DHCP	When checked, this setting instructs the device to accept LAN IP information assigned dynamically from another DHCP server already configured on your network. The ATU-R110 cannot act as a DHCP server for its own LAN port.

2. Enter a LAN IP address and network mask, or click the DHCP **Enable** radio button.

   - **Entering a fixed address:** If you are using routing services on you LAN such as DHCP and NAT, you will want to assign a fixed LAN IP address and mask. This ensures that your LAN computers have a fixed address that they use to communicate with the device.

     The IP address you assign must be on the same subnet as your LAN computers that connect to this port (that is, the network ID portion of their IP addresses and their subnet masks must be the same). See Appendix 0 for an explanation of IP addresses and network masks.

     You may need to update the DHCP configuration so that the addresses that the DHCP server dynamically assigns to your computers are on the same subnet as the new LAN IP address. See Chapter 7 for instructions on changing the pool of dynamically assigned addresses. In addition, if you change the DHCP pool, you will also need to update the NAT configuration so the new IP addresses are translated properly. See Chapter 8 for instructions on NAT.

   - **Enabling DHCP:** If another computer on your LAN provides DHCP services for your network, you can click the Use DHCP checkbox to enable the LAN port to accept a dynamically assigned address from the server. Check with your ISP to determine if this is advisable.

     When you click the Enable radio button, the LAN Network Mask field will be dimmed (made unavailable for entry). The LAN IP Address field will remain editable, however. The address that you specify here will be used as a

requested IP address from the DHCP server. This is referred to as a "Configured IP Address" in the program. If the configured IP address is not available from the DHCP server, the server will distribute another address to the LAN port. Even if another number is assigned, the same configured IP address will continue to display in this field.

For a description of how DHCP works, see Chapter 7.

3. Click Submit.

   - If you were using an Ethernet connection for the current session, and changed the IP address, the connection will be terminated.
   - If you enabled the DHCP service, the ADSL/Ethernet router will initiate a request for an IP address from your LAN's DHCP server. Assuming a different IP address is assigned, your current connection will be terminated.

4. Reconfigure your PCs, if necessary, so that their IP addresses place them in the same subnet as the new IP address of the LAN port. See the Quick Start chapter, "Part 2 – Configuring Your Computers," for instructions
5. Log into Configuration Manager by typing the new IP address in your Web browser's address location box

   If you enabled DHCP, you may need to check the DHCP server on your LAN to determine the IP address actually assigned to the LAN port.
6. If the new settings work properly click the Admin tab, and then click **Commit & Reboot** in the task bar.
7. Click Commit to save your changes to permanent memory.

6 Viewing System IP Information and Performance Statistics

The interfaces on the ATU-R110 that communicate with other network and Internet devices are identified by unique Internet protocol (IP) addresses. You can use the Configuration Manager to view the list of IP addresses that your device uses, and to view other system and network performance data.

See Appendix 0 for a description of IP addresses and masks.

Viewing the ATU-R110¡¦s IP addresses

To view the ATU-R110¡¦s IP addresses, click the Routing tab, and then click **IP Addr** in the task bar. The IP Address Table page displays, as shown in Figure 8:

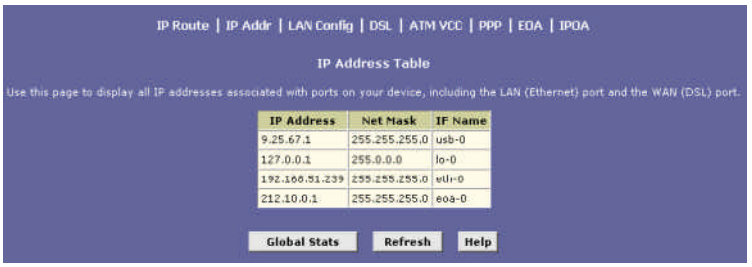


Figure 8. IP Address Table Page

The table lists the IP addresses, network masks (¡§Net Mask¡¨), and interface names (¡§IF Name¡¨) for each of its -enabled interfaces.

The listed IP addresses may include:

- The IP address of the device¡¦s LAN (Ethernet) port, called *eth-0*. See Chapter 5 for instructions on configuring this address.
- The IP address of the WAN (ADSL line) interface, which your ISP and other external devices use to identify your network. It may be identified in the Configuration Manager by the names *ppp-0* or *eoa-0*, or *ipoa-0*, depending on the protocol your device uses to communicate with your ISP. Your ISP may assign the same address each time, or it may change each time you reconnect.
- The ¡§loopback¡¨ IP address, named *lo-0*, of 127.0.0.1. This is a special address that enables the device to keep any data addressed directly to it, rather than route the data through the WAN or LAN ports.

If your device has additional IP-enabled interfaces, the IP addresses of these will also display.

Viewing IP Global Statistics

You can view statistics on the processing of Internet protocol packets (a packet is a collection of data that has been bundled for transmission). You will not typically need to view this data, but you may find it helpful when working with your ISP to diagnose network and Internet data transmission problems.

To view global IP statistics, click Global Stats on the IP Address Table page. Figure 9 shows the IP Global Statistics page:

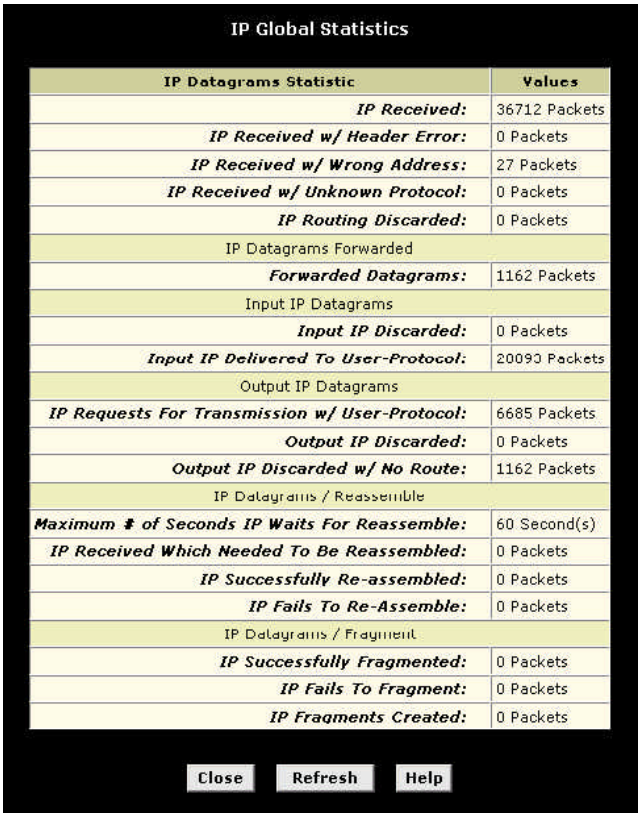

IP Global Statistics
IP Datagrams Statistic
Values
IP Received: 36712 Packets
IP Received w/ Header Error: 0 Packets
IP Received w/ Wrong Address: 27 Packets
IP Received w/ Unknown Protocol: 0 Packets
IP Routing Discarded: 0 Packets
IP Datagrams Forwarded
Forwarded Datagrams: 1162 Packets
Input IP Datagrams
Input IP Discarded: 0 Packets
Input IP Delivered To User-Protocol: 20090 Packets
Output IP Datagrams
IP Requests For Transmission w/ User-Protocol: 6685 Packets
Output IP Discarded: 0 Packets
Output IP Discarded w/ No Route: 1162 Packets
IP Datagrams / Reassemble
Maximum # of Seconds IP Waits For Reassemble: 60 Second(s)
IP Received Which Needed To Be Reassembled: 0 Packets
IP Successfully Re-assembled: 0 Packets
IP Fails To Re-Assemble: 0 Packets
IP Datagrams / Fragment
IP Successfully Fragmented: 0 Packets
IP Fails To Fragment: 0 Packets
IP Fragments Created: 0 Packets
Close
Refresh
Help

Figure 9. IP Global Statistics Page

To display updated statistics showing any new data since you opened the page, click Refresh.

7 Configuring Dynamic Host Configuration Protocol

You can configure your network and ATU-R110 to use the Dynamic Host Configuration Protocol (DHCP). This chapter provides an overview of DHCP and instructions for implementing it on your network.

Overview of DHCP

What is DHCP?

DHCP is a protocol that enables network administrators to centrally manage the assignment and distribution of IP information to computers on a network.

When you enable DHCP on a network, you allow a device ¡ such as the ATU-R110 or a router located with your ISP ¡ to assign temporary IP addresses to your computers whenever they connect to your network. The assigning device is called a *DHCP server*, and the receiving device is a *DHCP client*.

Note

If you used the Quick Start instructions, you either configured each LAN PC with an IP address, or you specified that it will receive IP information dynamically (automatically). If you chose to have the information assigned dynamically, then you configured your PCs as DHCP clients that will accept IP addresses assigned from a DCHP server such as the ATU-R110.

The DHCP server draws from a defined pool of IP addresses and ¡§leases¡¨ them for a specified amount of time to your computer when they request an Internet session. It monitors, collects, and redistributes the addresses as needed.

On a DHCP-enabled network, the IP information is assigned *dynamically* rather than *statically*. A DHCP client can be assigned a different address from the pool each time it reconnects to the network.

Why use DHCP?

DHCP allows you to manage and distribute IP addresses throughout your network from a central computer. Without DHCP, you would have to configure each computer separately with IP addresses and related information. DHCP is commonly used with large networks and those that are frequently expanded or otherwise updated.

ATU-R110 DHCP modes

The device can be configured as a DHCP server, DHCP relay agent, or, in some cases, a DHCP client.

- If you configure the device as a DHCP server, it will maintain the pool of addresses and distribute them to your LAN computers. If the pool of addresses includes private IP addresses, you must also configure the Network Address Translation service, so that the private addresses can be translated to your public IP address on the Internet. Both DHCP server and NAT are enabled in the default configuration.
- If your ISP performs the DCHP server function for your network, then you can configure the device as a DHCP relay agent. When the ATU-R110 receives a request for Internet access from a computer on your network, it contacts your ISP for the necessary IP information, and then relays the assigned information back to the computer.
- If you have another PC or device on your network that is already performing the DHCP server function, then you can configure the LAN port on the ATU-R110 to be a DHCP client of that server (as are your PCs). This configuration is not discussed in this chapter. See Chapter 5 for instructions.

Note

Configuring DHCP Server

Note

By default, the device is configured as a DHCP server, with a predefined IP address pool of 192.168.1.2 through 192.168.1.13 (subnet mask 255.255.255.0). To change this range of addresses, see ¡Viewing, modifying, and deleting address pools¡¨ on page 46.

First, you must configure your PCs to accept DHCP information assigned by a DHCP server:

1. Open the Windows Control Panel and display the computer's Networking properties. Configure the TCP/IP properties to "Obtain an IP address automatically" (the actual text may vary depending on your operating system). For detailed instructions, see the Quick Start chapter, ¡Part 2 ¡ Configuring Your Computers.¡

Next, you define the pools of IP addresses you want to make available for distribution to your computers. These addresses can be multiple public addresses that you have purchased from your ISP, but are typically private addresses that you create. (LAN administrators often create private IP addresses for use only on their networks. See ¡Overview of NAT¡¨ on page 51.)

2. Log into Configuration Manager, click the LAN tab, and then click **DHCP Server** in the task bar.

   The DHCP Server Configuration page displays:

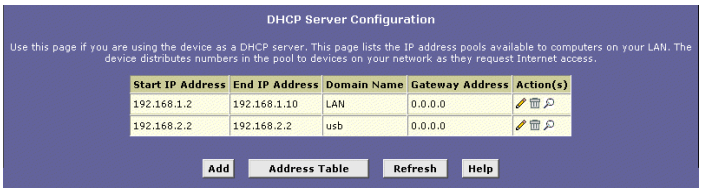


Figure 10. DHCP Configuration Page

   Each pool you create displays in a row on the table on this page.

   You can create up to eight pools; however, most users will need to create only one for their LAN.

3. To add an IP address pool, click **Add**.

   The DHCP Server Pool ¡ Add page displays.

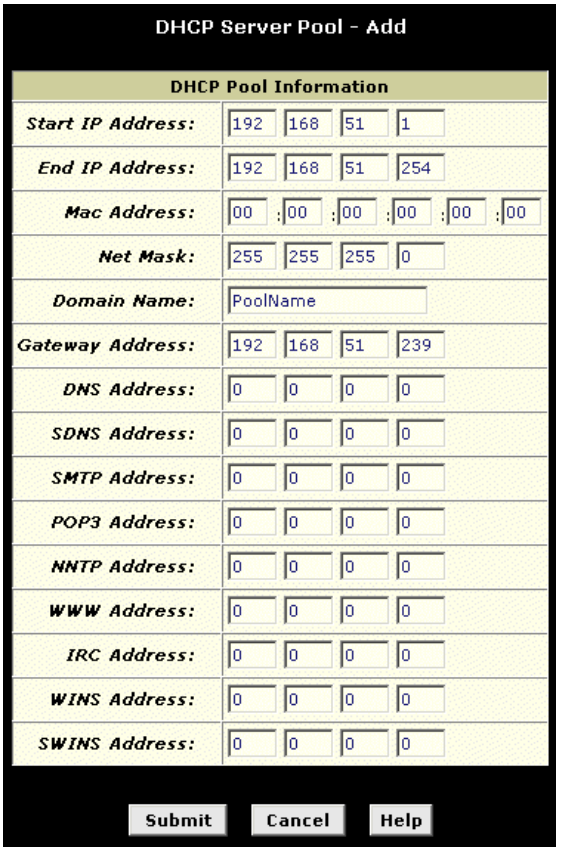

DHCP Server Pool - Add
DHCP Pool Information
Start IP Address: 192 168 51 1
End IP Address: 192 168 51 254
Mac Address: 00 :00 :00 :00 :00 :00
Net Mask: 255 255 255 0
Domain Name: PoolName
Gateway Address: 192 168 51 239
DNS Address: 0 0 0 0
SDNS Address: 0 0 0 0
SMTP Address: 0 0 0 0
POP3 Address: 0 0 0 0
NNTP Address: 0 0 0 0
WWW Address: 0 0 0 0
IRC Address: 0 0 0 0
WINS Address: 0 0 0 0
SWINS Address: 0 0 0 0
Submit
Cancel
Help

Figure 11. DHCP Server Pool ¡ Add Page

4. Enter the *Start IP Address*, *End IP Address*, *Net Mask*, and *Gateway Address* fields are required; the others are optional. The following table describes each field.

Field	Description
Start/End IP Addresses	Specify the lowest and highest addresses in the pool.
Mac Address	Use this field only if you want to assign a specific IP address to a specific computer (that is, you are creating an exception to the dynamic assignment of addresses). The IP address you specify will be assigned to the computer that corresponds to this MAC address. (A MAC address is a manufacturer-assigned hardware ID that is unique for each device on a network.) If you type a MAC address here, you must have specified the same IP address in both the Start IP Address and End IP Address fields.
Net Mask	Specifies which portion of each IP address in this range refers to the network and which portion refers to the host (computer). For a description of network masks and LAN network masks, see Appendix 0. You can use the network mask to distinguish which pool of addresses should be distributed to a particular subset of computers on your LAN (called a *subnet*).
Domain Name	A user-friendly name that refers to the group of computers (subnet) that will be assigned addresses from this pool.
Gateway Address	The address of the default gateway for computers that receive IP addresses from this pool. The default gateway is the IP address that the computers first contact to communicate with the Internet. Typically, it is the device¡¦s LAN port IP address. See ¡Hops and gateways¡¨ on page 74 for an explanation of gateway addresses.
DNS/SDNS Address	The IP address of the *Domain Name System* server and *Secondary Domain Name System* server to be used by computers that receive IP addresses from this pool. These DNS servers translate common Internet names that you type into your web browser into their equivalent numeric IP addresses. Typically, these servers are located with your ISP.

Field	Description
SMTP...SWINS (optional)	The IP addresses of devices that perform various services for computers that receive IP addresses from this pool (such as the SMTP, or *Simple Mail Transfer Protocol*, server which handles e-mail traffic). Contact your ISP for these addresses.

5. Click Submit.

   A confirmation page displays briefly to indicate that the pool has been added successfully. After a few seconds, the DHCP Server Pool ¡ Add page displays with the newly added pool.

6. Follow the instructions in ¡Setting the DHCP Mode¡¨ on page 49 to set the DHCP mode to DHCP Server.

Viewing, modifying, and deleting address pools, and excluding IP addresses from a pool

To view, modify, or delete an existing address pool, display the DHCP Server Configuration page, and click the icons in the corresponding row in the address pool table.

- To delete an IP address pool, click , then submit and commit your changes.
- To view details on an IP address pool, click . A page displays with all the same information you entered when adding the pool.

  To modify the domain name associated with an IP address pool, or to exclude addresses from the pool, click . The DHCP Server Pool ¡ Modify page displays, as shown in Figure 12.

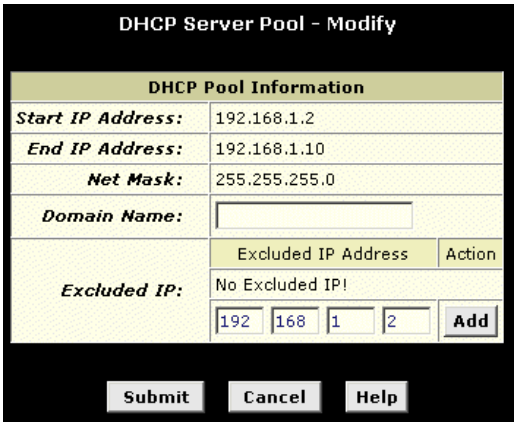


Figure 12. DHCP Server Pool ¡ Modify Page

Excluded addresses are those that you have designated for fixed use with specific devices, or for some other reason do not want to make available to your network.

To exclude an address from distribution, type it in the fields provided and click Add. Click Submit after entering your changes. Be sure to use the Commit feature to save your changes to permanent memory, as described on page 32.

Viewing current DHCP address assignments

When the ATU-R110 functions as a DHCP server for your LAN, it keeps a record of any addresses it has leased to your computers. To view a table of all current IP address assignments, display the DHCP Server Configuration page, and then click Address Table.

A page displays similar to that shown in Figure 13:

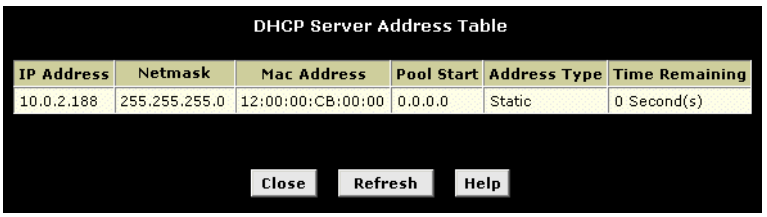


Figure 13. DHCP Server Address Table Page

The DHCP Server Address Table lists any IP addresses that are currently leased to LAN devices. For each leased address, the table lists the following information:

Field	Description
IP Address	The address that has been leased from the pool.
Netmask	The network mask associated with the leased address, which identifies the network ID and host ID portions of the address (see Appendix A).
Mac Address	A hardware ID for the device to which the number has been assigned.
Pool Start	The lower boundary of the address pool (provided to identify the pool from which the leased number came).
Address Type	Static or Dynamic. *Static* indicates that the IP number has been assigned permanently to the specific hardware device. *Dynamic* indicates that the number has been leased temporarily for a specified length of time.
Time Remaining	The amount of time left for the device to use the assigned address.

Configuring DHCP Relay

Some ISPs perform the DHCP server function for their customers¡¦ home/small office networks. In this case, you can configure the device as a DHCP relay agent. When a computer on your network requests Internet access, the ATU-R110 contacts your ISP to obtain an IP address (and other information), and then forwards that information to the computer.

First, you must configure your PCs to accept DHCP information assigned by a DHCP server:

1. Open the Windows Control Panel and display the computer's Networking properties. Configure the TCP/IP properties to "Obtain an IP address automatically" (the actual text may vary depending on your operating system). For detailed instructions, see the Quick Start chapter, ¡Part 2 ¡ Configuring Your Computers.¡

Next, you specify the IP address of the DHCP server and select the interfaces on your network that will be using the relay service.

2. Log into the Configuration Manager, click the LAN tab, and then click **DHCP Relay** in the task bar.

   The DHCP Relay Configuration page displays:

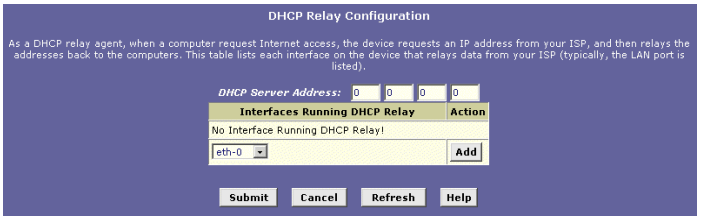

DHCP Relay Configuration
As a DHCP relay agent, when a computer request Internet access, the device requests an IP address from your ISP, and then relays the addresses back to the computers. This table lists each interface on the device that relays data from your ISP (typically, the LAN port is listed).
DHCP Server Address:
0
0
0
0
Interfaces Running DHCP Relay
Action
No Interface Running DHCP Relay!
eth-0
Add
Submit
Cancel
Refresh
Help

   Figure 14. DHCP Relay Configuration Page

3. Type the IP address of your ISP¡¦s DHCP server in the fields provided.

   If you do not have this number, it is not essential to enter it here. Requests for IP information from your LAN will be passed to the default gateway, which should route the request appropriately.

4. If the interface named eth-0 is not already displaying, select it from the drop-down list and click **Add**.

   The eth-0 interface specifies that your default Ethernet (LAN) interface is running DHCP relay for your LAN. Typically, this is the only interface you need to specify here. If the ATU-R110 has additional interfaces that you want to perform DHCP relay, you can select and add them.

   (You can also delete an interface from the table by clicking in the right column.)

5. Click **Submit**.

A page displays to confirm your changes, and then the program returns to the DHCP Relay Configuration page.

6. Follow the instructions in ¡Setting the DHCP Mode¡¨ on page 49 to set the DHCP mode to DHCP Relay.

Setting the DHCP Mode

You should set the DHCP mode only after you have configured DHCP relay or DHCP server settings. See ¡Configuring DHCP Server¡¨ on page 43 or ¡Configuring DHCP Relay¡¨ on page 48 for additional instructions.

Follow these instructions to set the DHCP mode:

1. Click the LAN tab, and then click **DHCP Mode** in the task bar.
2. From the DHCP Mode drop-down list, choose **DHCP Server**, **DHCP Relay**, or **none**.

   If you choose none, your LAN computers must be configured with static IP addresses.
3. Click

.
4. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
5. Click

to save your changes to permanent memory.

8 Configuring Network Address Translation

This chapter provides an overview of Network Address Translation (NAT) and instructions for modifying the default configuration on your device.

Overview of NAT

Network Address Translation is a method for disguising the private IP addresses you use on your LAN as the public IP address you use on the Internet. You define NAT rules that specify exactly how and when to translate between public and private IP addresses.

Definitions

*A **private IP address** is created by a network administrator for use only on a LAN, whereas a **public IP address** is purchased from the Internet Corporation for Assigned Names and Numbers (ICANN) for use on the Internet. Typically, your ISP provides a public IP address for your entire LAN, and you define the private addresses for computers on your LAN.*

In a typical NAT setup, your ISP provides you with a single public IP address to use for your entire network. Then, you assign each computer on your LAN a unique private IP address. (Or, you define a pool of private IP addresses for dynamic assignment to your computers, as described in Chapter 7.) On the ATU-R110, you set up a NAT rule to specify that whenever one of your computers communicates with the Internet, (that is, it sends and receives IP *data packets*) its private IP address¡ which is referenced in each packet¡ will be replaced by the LAN¡¦s public IP address

Definitions

*An **IP data packet** contains bits of data bundled together in a specific format for efficient transmission over the Internet. Such packets are the building blocks of all Internet communication. Each packet contains header information that identifies the IP address of the computer that initiates the communication (the **source IP address**), the port number that the router associates with that computer (the **source port number**), the IP address of the targeted Internet computer (the **destination IP address**), and other information.*

When this type of NAT rule is applied, because the source IP address is swapped out, it appears to other Internet computers as if the data packets are actually originating from the computer assigned your public IP address (in this case, the ATU-R110).

The NAT rule could further be defined to disguise the source port in the data packet (i.e., change it to another number), so that outside computers will not be able to determine the actual port from which the packet originated. Data packets that arrive in response contain the public IP address as the destination IP address and the disguised source port number. The ATU-R110 changes the IP

address and source port number back to the original values (having kept track of the changes it made earlier), and then routes the packet to the originating computer.

NAT rules such as these provide several benefits:

- They eliminate the need for purchasing multiple public IP addresses for computers on your LAN. You can make up your own private IP addresses at no cost, and then have them translated to the public IP address when your computers access the Internet.
- They provide a measure of security for you LAN by enabling you to assign private IP addresses and then have these and the source port numbers swapped out before your computers access the Internet.

The type of NAT function described above is called *network address port translation* (napt). You can use other types, called *flavors*, of NAT for other purposes; for example, providing outside access to your LAN or translating multiple private addresses to multiple public addresses.

Your Default NAT Setup

By default, NAT is enabled, with an napt rule configured to perform the following translation:

These private IP addresses:	...are translated to:
192.168.1.2 192.168.1.3 . . . 192.168.1.13	Your ISP-assigned public IP address

For a description of napt rules, see page 58. This default NAT setup assumes that, on each LAN computer, you configured TCP/IP properties as follows:

- You selected the check box that enables them to receive their IP addresses automatically (that is, to use a DHCP server);

  or,

- You assigned static IP addresses to your PCs in the range 192.168.1.2 through 192.168.1.13.

If your computers are not configured in one of these ways, you can either change the IP addresses on your computers to match the NAT setup (see the Quick Start instructions, Part 2), or delete this NAT rule and add a new one that matches the addresses you assigned to your computers (see ¡ Adding NAT Rules¡¨ on page 58 for instructions).

Viewing NAT Global Settings and Statistics

To view your NAT settings, log into Configuration Manager, click the Services tab. The NAT Configuration page displays by default, as shown in Figure 15.

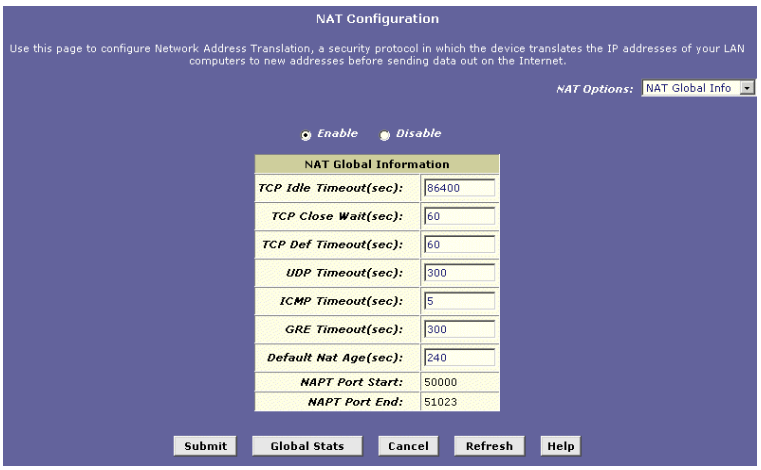


Figure 15. NAT Configuration Page

The NAT Configuration page contains the following elements:

- The NAT Options drop-down list, which provides access to the Global Information page (shown by default), the NAT Rule Configuration page, and the NAT Translations page, which shows current translations.
- Enable/Disable radio buttons, which allow you to turn on or off the NAT feature.
- The NAT Global Information table, which displays the following settings that apply to all NAT rule translations:

Field	Description
TCP Idle Timeout (sec)	For a NAT translation session on data that uses the TCP protocol, the translation will no longer be performed if no matching data packets are received after the specified time has elapsed.
TCP Close Wait (sec)	For a NAT translation on data using the TCP protocol, after a communication session has been closed, the translation will no longer be performed if no matching data packets are received after the specified time has elapsed.
TCP Def Timeout (sec)	For a NAT translation session on data that uses the TCP protocol, the translation will no longer be performed if no matching data packets are received after the specified time has elapsed.
UDP Timeout (sec)	Same as TCP Idle Timeout, but for UDP packets.
ICMP Timeout (sec)	Same as TCP Idle Timeout, but for ICMP

Field	Description
	packets.
GRE Timeout (sec)	Same as TCP Idle Timeout, but for GRE packets.
Default Nat Age (sec)	For all other NAT translation sessions, the number of seconds after which a translation session will no longer be valid.
NAPT Port Start/End	When an napt rule is defined, the source ports will be translated to sequential numbers in this range.

If you change any values, click Submit, and then click the Admin tab and commit your changes to permanent system memory (see page 32).

You can click Global Stats to view accumulated data on how many NAT rules have been invoked and how much data has been translated. A page similar to the one shown in Figure 16 displays.

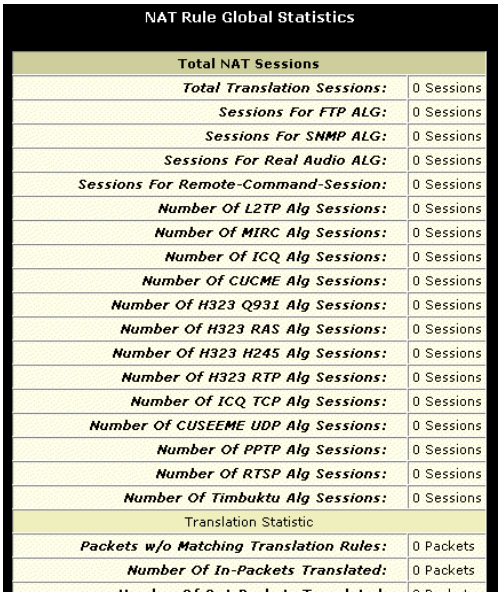

NAT Rule Global Statistics
Total NAT Sessions
Total Translation Sessions: 0 Sessions
Sessions For FTP ALG: 0 Sessions
Sessions For SNMP ALG: 0 Sessions
Sessions For Real Audio ALG: 0 Sessions
Sessions For Remote-Command-Session: 0 Sessions
Number Of L2TP Alg Sessions: 0 Sessions
Number Of MIRC Alg Sessions: 0 Sessions
Number Of ICQ Alg Sessions: 0 Sessions
Number Of CUCME Alg Sessions: 0 Sessions
Number Of H323 Q931 Alg Sessions: 0 Sessions
Number Of H323 RAS Alg Sessions: 0 Sessions
Number Of H323 H245 Alg Sessions: 0 Sessions
Number Of H323 RTP Alg Sessions: 0 Sessions
Number Of ICQ TCP Alg Sessions: 0 Sessions
Number Of CUSEEME UDP Alg Sessions: 0 Sessions
Number Of PPTP Alg Sessions: 0 Sessions
Number Of RTSP Alg Sessions: 0 Sessions
Number Of Timbuktu Alg Sessions: 0 Sessions
Translation Statistic
Packets w/o Matching Translation Rules: 0 Packets
Number Of In-Packets Translated: 0 Packets

Figure 16. NAT Rule Global Statistics Page

The table provides basic information for each NAT rule you have set up. You can click Clear to restart the accumulation of the statistics at their initial values.

Viewing NAT Rules and Rule Statistics

To view the NAT rules currently defined on your system, select **NAT Rule Entry** in the NAT Options drop-down list. The NAT Rule Configuration page displays, as shown in Figure 17.

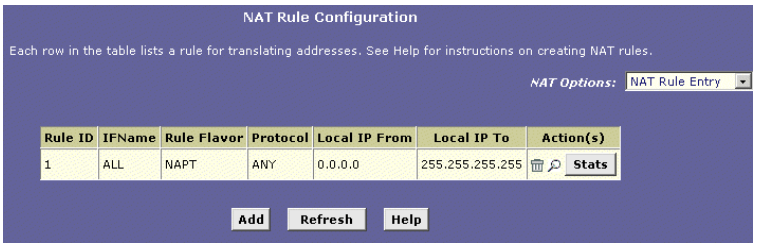


Figure 17. NAT Rule Configuration Page

The NAT Rule Configuration table displays a row containing basic information for each rule. For a description of these fields, refer to the instructions for adding rules (pages 58 through 67).

From the NAT Rule Configuration page, you can click **Add** to add a new rule, or use the icons in the right column to delete (🗑) or view details on (🔎) a rule.

To view data on how often a specific NAT rule has been used, click **Stats** in the Action(s) column. A page similar to the one show in Figure 18 displays:

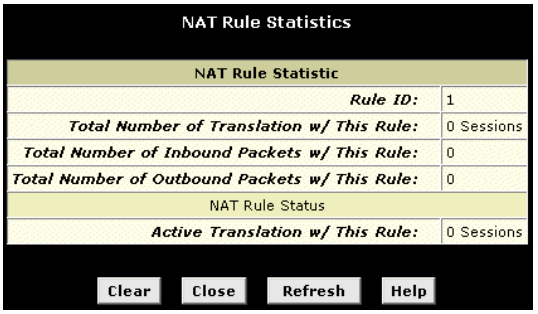

NAT Rule Statistics
NAT Rule Statistic
Rule ID: 1
Total Number of Translation w/ This Rule: 0 Sessions
Total Number of Inbound Packets w/ This Rule: 0
Total Number of Outbound Packets w/ This Rule: 0
NAT Rule Status
Active Translation w/ This Rule: 0 Sessions
Clear
Close
Refresh
Help

Figure 18. NAT Rule Statistics Page

The statistics show how many times this rule has been invoked and how many currently active sessions are using this rule. You can click **Clear** to reset the statistics to zeros and **Refresh** to display newly accumulated data.

Viewing Current NAT Translations

To view a list of NAT translations that have recently been performed and which remain in effect (for any of the defined rules), select **NAT Translations** from the NAT Options drop-down list. The NAT Translations page displays, as shown in Figure 19:

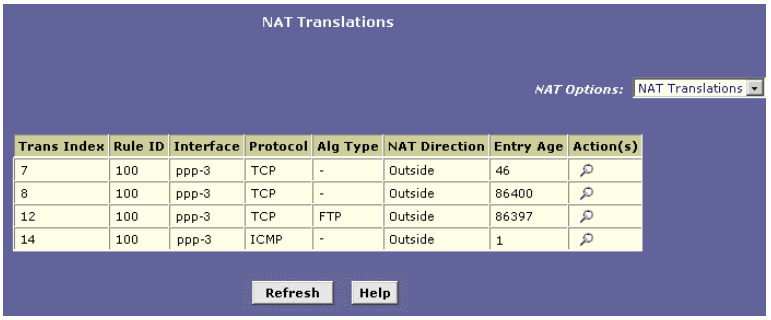

NAT Translations
NAT Options: NAT Translations
Trans Index | Rule ID | Interface | Protocol | Alg Type | NAT Direction | Entry Age | Action(s)
7 | 100 | ppp-3 | TCP | - | Outside | 46
8 | 100 | ppp-3 | TCP | - | Outside | 86400
12 | 100 | ppp-3 | TCP | FTP | Outside | 86397
14 | 100 | ppp-3 | ICMP | - | Outside | 1
Refresh
Help

Figure 19. NAT Translations Page

For each current NAT translation session, the table contains the following fields:

Field	Description
Trans Index	The sequential number assigned to the IP session used by this NAT translation session.
Rule ID	The ID of the NAT rule invoked.
Interface	The device interface on which the NAT rule was invoked (from the rule definition).
Protocol	The IP protocol used by the data packets that are undergoing translations (from the rule definition) Example: TCP, UDP, ICMP.
Alg Type	The *Application Level Gateway* (ALG), if any, that was used to enable this NAT translation (ALGs are special settings that certain applications require in order to work while NAT is enabled).
NAT Direction	The direction (incoming or outgoing) of the translation (from the port definition).
Entry Age	The elapsed time, in seconds, of the NAT translation session.

You can click in the Action(s) column to view additional details about a NAT translation session, as shown in Figure 20.

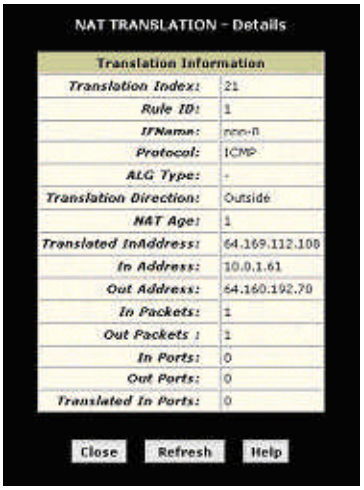


Figure 20. NAT Translation ¡ Details Page

In addition to the information displayed in the NAT Translations table, this table displays the following for the selected current translation sessions:

Field	Description
Translated InAddress	The public IP address to which the private IP address was translated.
In Address	The private IP address that was translated.
Out Address	The IP address of the outside destination (web, ftp site, etc.)
In/Out Packets	The number of incoming and outgoing IP packets that have been translated in this translation session.
In Ports	The actual port number corresponding to the LAN computer.
Out Ports	The port number associated with the destination address.
Translated In Ports	The port number to which the LAN computer¡¦s actual port number was translated.

Adding NAT Rules

This section explains how to create rules for the various NAT flavors.

Note

The napt rule: Translating between private and public IP addresses

Follow these instructions to create a rule for translating the private IP addresses on your LAN to your public IP address. This type of rule uses the NAT flavor napt, which was used in your default configuration. The napt flavor translates private source IP addresses to a single public IP address. The napt rule also translates the source port numbers to port numbers that are defined on the NAT Global Configuration page (see page 53). The Introduction to NAT on page 51 describes how the napt rule works.

1. Click the NAT tab, then select **NAT Rule Entry** from the NAT Options drop-down list on the right side of the page.

   The NAT Rule entry page displays a row for each currently configured NAT rule.

2. Click Add to display the NAT Rule ¡ Add page.

   The NAPT flavor displays by default in the Rule Flavor drop-down list. The NAT Rule ¡ Add page displays, as shown in Figure 21.

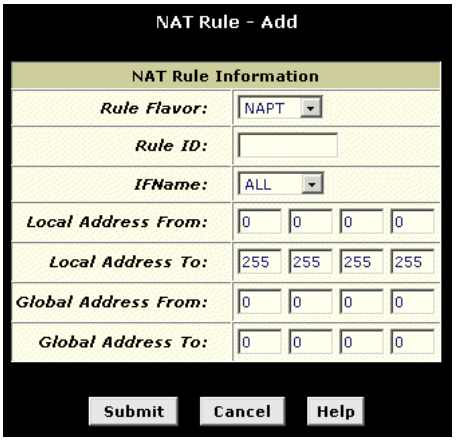


Figure 21. NAT Rule ¡ Add Page (napt Flavor)

3. Enter a Rule ID.

   The Rule ID determines the order in which rules are invoked (the lowest numbered rule is invoked first, and so on). In some cases, two or more rules may be defined to act on the same set of IP addresses. Be sure to assign the Rule ID so that the

higher priority rules are invoked before lower-priority rules. It is recommended that you select rule IDs as multiples of 5 or 10 so that, in the future, you can insert a rule between two existing rules.

Once a data packet matches a rule, the data is acted upon according to that rule and is not subjected to higher-numbered rules.

4. From the IFName drop-down list, select the interface on the device to which this rule applies.

   Typically, NAT rules are used for communication between your LAN and the Internet. Because the device uses the WAN interface (which may be named *ppp-0* or *eoa-0*) to connect your LAN to your ISP, it is the usual IFName selection.

5. In the Local Address From field and Local Address To fields, type the starting and ending IP addresses, respectively, of the range of private address you want to be translated. Or, type the same address in both fields to specify a single value.

   To specify that data from all LAN addresses should be translated, type 0 (zero) in each From field and 255 in each To field.

   If you have several non-sequential private addresses, you can create an additional napt rule for each address.

   These addresses should correspond to private addresses already in use on your network (either assigned statically to your PCs, or assigned dynamically using DHCP, as discussed in the Quick Start).

6. In the Global Address From and Global Address To fields, type the public IP address assigned to you by your ISP.

   If you have multiple WAN interfaces, in both fields type the IP address of the interface to which this rule applies. This rule will not be enforced for data that arrives on other PPP interfaces.

   If you have multiple WAN interfaces and want the rule to be enforced on a range of them, type the starting and ending IP addresses of the range.

7. When you have completed entering all information, click Submit.

   A page displays to confirm the change.

8. Click Close to return to the NAT Configuration page.

   The new rule should display in the NAT Rule Configuration table.

9. Ensure that the Enable radio button is selected, and then click Submit.

   A page displays to confirm your changes.

10. Click the Admin tab, and then click **Commit and Reboot** in the task bar.

11. Click Commit to save your changes to permanent memory.

The rdr rule: Allowing external access to a LAN computer

You can create an rdr rule to make a computer on your LAN, such as a Web or FTP server, available to Internet users without requiring you to obtain a public IP address for that computer. The computer's private IP address is translated to your public IP address in all incoming and outgoing data packets.

Note

The following example illustrates using the rdr rule to provide external access to your web server:

Your ADSL/Ethernet router receives a packet containing a request for access to your Web server. The packet header contains the public address for your LAN as the destination IP address, and a destination port number of 80. Because you have set up an rdr rule for incoming packets with destination port 80, the device recognizes the data as a request for Web server access. The device changes the packet's destination address to the private IP address of your Web server and forwards the data packet to it.

Your Web server sends data packets in response. Before the ADSL/Ethernet router forwards them on to the Internet, it changes the source IP address in the data packets from the Web server's private address to your LAN's public address. To an external Internet user then, it appears as if your Web server uses your public IP address.

Figure 22 shows the fields used to establish an rdr rule:

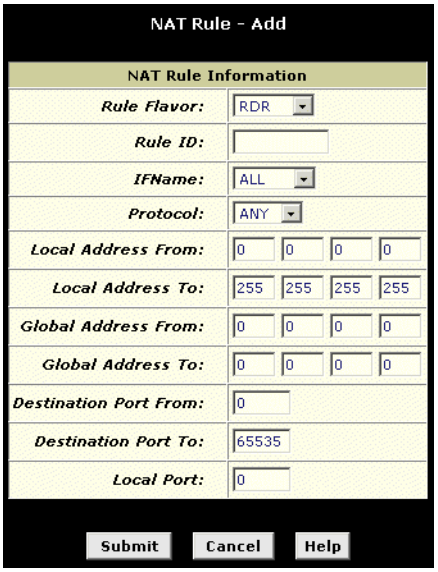


Figure 22. NAT Rule ¡ Add Page (rdr Flavor)

Follow these instructions to add an rdr rule (see steps 1-4 under "The napt rule" on page 58 for specific instructions corresponding to steps 1 and 2 below):

1. Display the NAT Rule ¡ Add Page, select **RDR** as the Rule Flavor, and enter a Rule ID.
2. Select the interface on which this rule will be effective.
3. Select a protocol to which this rule applies, or choose **ALL**.

   This selection specifies which type of Internet communication will be subject to this translation rule. You can select ALL if the rule applies to all data. Or, select TCP, UDP, ICMP, or a number from 1-255 that represents the IANA-specified protocol number.
4. In the Local Address From and Local Address To fields, type the same private IP address, or the lowest and highest addresses in a range:

   - If you type the same IP address in both fields, incoming traffic that matches the criteria you specify in steps 5 and 6 will be redirected to that IP address.
   - If you type a range of addresses, incoming traffic will be redirected to any available computer in that range. This option would typically be used for load balancing, whereby traffic is distributed among several redundant servers to help ensure efficient network performance.

   These addresses should correspond to private addresses already in use on your network (either assigned statically to your PCs or assigned dynamically using DHCP, as discussed in the Quick Start, Part 2).
5. In the Global Address From and Global Address To fields, type the public IP address assigned to you by your ISP.

If you have multiple WAN (PPP) interfaces, this rule will not be enforced for data that arrives on other PPP interfaces. This rule will not be enforced for data that arrives on WAN interfaces not specified here.

If you have multiple WAN interfaces and want the rule to be enforced on more than one of them (or all), type the starting and ending IP addresses of the range.

6. In the Destination Port From and Destination Port To fields, enter the port ID (or a range) that you expect to see on incoming packets destined for the LAN computer for which this rule is being created.

   Incoming traffic that meets this criteria will be redirected to the Local Port number you specify in the next field.

   For example, if you grant public access to a Web server on your LAN, you would expect that incoming packets destined for that computer would contain the well-known web server port number, 80. This setting serves as a filter; data packets not containing this port number would not be granted access to you local computer.

7. If the LAN computer that you are making publicly available is configured to use a non-standard port number for the type of traffic it receives, type the non-standard port number in the Local Port field.

   This option translates the standard port number in packets destined for your LAN computer to the non-standard number you specify. For example, if your Web server uses (non-standard) port 2000, but you expect incoming data packets to refer to (standard) port 80, you would enter 2000 here and 80 in the Destination Port fields. The headers of incoming packets destined for port 80 will be modified to refer to port 2000. The packet can then be routed appropriately to the web server.

8. Follow steps 7-12 under "The napt rule" on page 58 to submit your changes.

The basic rule: Performing 1:1 translations

The basic flavor translates the private (LAN-side) IP address to a public (WAN-side) address, like napt rules. However, unlike napt rules, basic rules do not also translate the port numbers in the packet header; they are passed through untranslated. Therefore, the basic rule does not provide the same level of security as the napt rule.

Figure 23 shows the fields used for adding a basic rule.

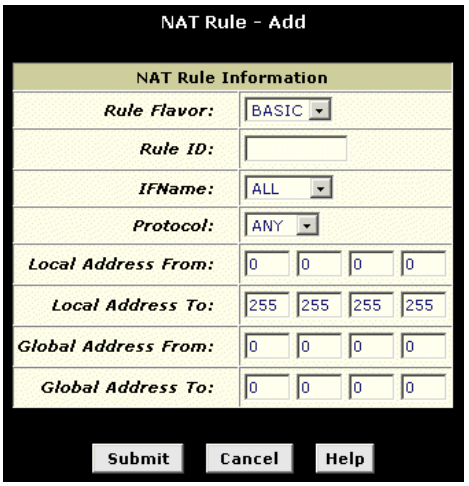


Figure 23. NAT Rule ¡ Add Page (basic Flavor)

Follow these instructions to add an basic rule (see steps 1-4 under "The napt rule" on page 58 for specific instructions corresponding to steps 1 and 2 below):

1. Display the NAT Rule ¡ Add Page, select **BASIC** as the Rule Flavor, and enter a Rule ID.
2. Select the interface on which this rule will be effective.
3. Select a protocol to which this rule applies, or choose **ALL**.

   This selection specifies which type of Internet communication will be subject to this translation rule. You can select ALL if the rule applies to all data. Or, select TCP, UDP, ICMP, or a number from 1-255 that represents the IANA-specified protocol number.
4. In the Local Address From and Local Address To fields, type the starting and ending IP addresses that identify the range of private address you want to be translated. Or, type the same address in both fields.

   If you specify a range, each address will be translated in sequence to a corresponding address in a range of global addresses (which you specify in step 5).

   You can create a basic rule for each specific address translation to occur. The range of addresses should correspond to private addresses already in use on your network, whether

assigned statically to your PCs, or assigned dynamically using DHCP.

5. In the Global Address From and Global Address To fields, type the starting and ending address that identify the pool of public IP addresses that the private addresses should be translated to. Or, type the same address in both fields (if you also specified a single address in step 4).
6. Follow steps 7-12 under "The napt rule" on page 58 to submit your changes.

The filter rule: Configuring a basic rule with additional criteria

Like the basic flavor, the filter flavor translates public and private IP addresses on a one-to-one basis. The filter flavor extends the capability of the basic rule. Refer to ¡ §The bsic Rule¡ ¨ on page63 for a general description.

You can use the filter rule if you want an address translation to occur only when your LAN computers initiate access to specific destinations. The destinations can be identified by their IP addresses, server type (such as FTP or Web server), or both.

Figure 24 shows the fields used to establish a filter rule.

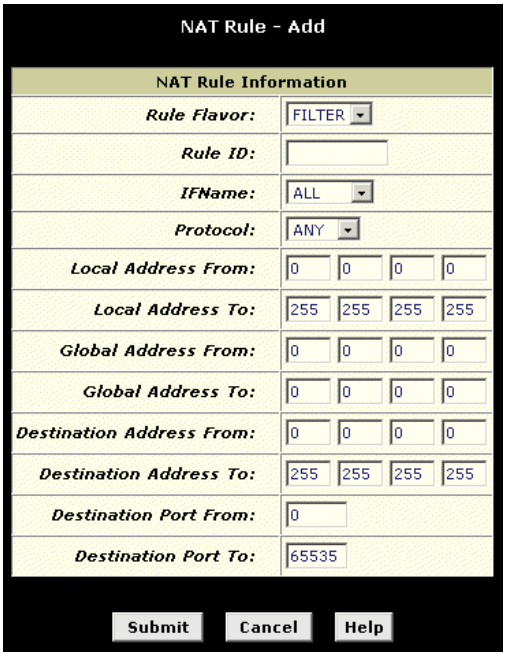


Figure 24. NAT Rule„ Add Page (filter Flavor)

Follow these instructions to add a filter rule (see steps 1-4 under "The napt rule" on page 58 for specific instructions corresponding to steps 1 and 2 below):

1. Display the NAT Rule ¡ Add Page, select **FILTER** as the Rule Flavor, and enter a Rule ID.
2. Select the interface on which this rule will be effective.

3. Select a protocol to which this rule applies, or choose **ALL**.

   This selection specifies which type of Internet communication will be subject to this translation rule. You can select ALL if the rule applies to all data. Or, select TCP, UDP, ICMP, or a number from 1-255 that represents the IANA-specified protocol number.

4. In the Local Address From and Local Address To fields, type the starting and ending IP addresses that identify the range of private address you want to be translated. Or, type the same address in both fields.

   If you specify a range, each address will be translated in sequence to a corresponding address in a range of global addresses (which you specify in step 5).

   The address (or range of addresses) should correspond to a private addresses (or addresses) already in use on your network. These may be assigned statically to your PCs or assigned dynamically using DHCP, as discussed in the Quick Start.

5. In the Global Address From and Global Address To fields, type the starting and ending address that identify the range of public IP addresses to translate your private addresses to. Or, type the same address in both fields (if you also specified a single address in step 4).

6. Specify a Destination Address or addresses, Destination Port (or ports), or both. You can specify a single value by entering that value in both fields.

   - Specify a destination address (or range) if you want this rule to apply only to outbound traffic to the address (or range).

     If you enter only the network ID portion of the destination address, then the rule will apply to outbound traffic to all computers on network.

   - Specify a destination ports (or range) if you want this rule to apply to any outbound traffic to the types of servers identified by that port number.

     For example, if you do not specify a destination address, but specify a Destination Port From/To of 21, then this translation will occur on all accesses by your LAN to all external FTP servers (that is, when one of your LAN computers communicates with an external FTP server, the source IP address in the packet headers is changed to the public address, replacing the initiator's private IP address).

     Port number assignments are maintained in RFCs maintained by IANA. Common port numbers include:
     20, 21¡ FTP (file transfer protocol) server
     25¡ SMTP (simple mail transfer protocol) server
     80¡ HTTP (World Wide Web) server

   - Specify both a destination address (or range) and a destination port (or range) if you want this translation rule to

apply to accesses to the specified server type at the specified IP address or network.

7. Follow steps 7-12 under "The napt rule" on page 58 to submit your changes.

The bimap rule: Performing two-way translations

Unlike the other NAT flavors, the bimap flavor performs address translations in both the outgoing and incoming directions.

In the incoming direction, when the specified ATU-R110 interface receives a packet with your public IP address as the destination address, this address is translated to the private IP address of a computer on your LAN. To the external computer, it appears as if the access is being made to the public IP address, when, in fact, it is communicating with a LAN computer.

In the outgoing direction, the private source IP address in a data packet is translated to the LAN¡¦s public IP address. To other hosts of the Internet, it appears as if the data packet originated from the public IP address.

Bimap rules can be used to provide external access to a LAN device. They do not provide the same level of security as rdr rules, because rdr rules also reroute incoming packets based on the port ID. Bimap rules do not account for the port number, and therefore allow external access regardless of the destination port type specified in the incoming packet.

Figure 25 shows the fields used to establish a bimap rule.

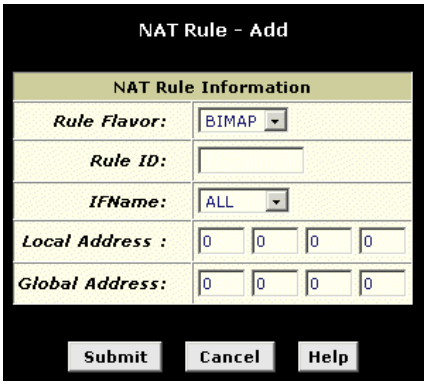


Figure 25. NAT Rule ¡ Add Page (bimap Flavor)

Follow these instructions to add a bimap rule (see steps 1-4 under "The napt rule" on page 58 for specific instructions corresponding to steps 1 and 2 below):

1. Display the NAT Rule ¡ Add Page, select **BIMAP** as the Rule Flavor, and enter a Rule ID.
2. Select the interface on which this rule will be effective.
3. In the Local Address field, type the private IP address of the computer to which you are granting external access.
4. In the Global Address field, type the address that you want to serve as the publicly known address for the LAN computer.

5. Follow steps 7-12 under "The napt rule" on page 58 to submit your changes.

The pass rule: Allowing specific addresses to pass through untranslated

You can create a pass rule to allow a range of IP addresses to remain untranslated when another rule would otherwise do so.

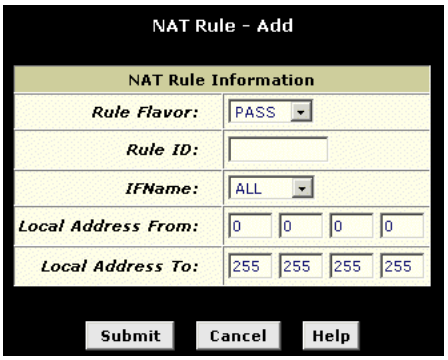


Figure 26. NAT Rule ¡ Add Page (pass Flavor)

The pass rule must be assigned a rule ID that is a lower number than the ID assigned to the rule it is intended to pass. In you want a specific IP address or range of addresses to not be subject to an existing rule, say rule ID #5, then you can create a pass rule with ID #1 through #4.

Follow these instructions to add a pass rule (see steps 1-4 under "The napt rule" on page 58 for detailed instructions corresponding to steps 1 and 2 below):

1. Display the NAT Rule ¡ Add Page, select **PASS** as the Rule Flavor, and enter a Rule ID.
2. Select the interface on which this rule will be effective.
3. In the Local Address From and Local Address To fields, type the lowest and highest IP addresses that define the range of private address you want to be passed without translation.

   If you want the pass rule to act on only one address, type that address in both fields.
4. Follow steps 7-12 under "The napt rule" on page 58 to submit your changes.

9 Configuring DNS Server Addresses

About DNS

Domain Name System (DNS) servers map the user-friendly domain names that users type into their Web browsers (e.g., "yahoo.com") to the equivalent numerical IP addresses that are used for Internet routing.

When a PC user types a domain name into a browser, the PC must first send a request to a DNS server to obtain the equivalent IP address. The DNS server will attempt to look up the domain name in its own database, and will communicate with higher-level DNS servers when the name cannot be found locally. When the address is found, it is sent back to the requesting PC and is referenced in IP packets for the remainder of the communication.

Assigning DNS Addresses

Multiple DNS addresses are useful to provide alternatives when one of the servers is down or is encountering heavy traffic. ISPs typically provide primary and secondary DNS addresses, and may provide additional addresses. Your LAN PCs learn these DNS addresses in one of the following ways:

- **Statically:** If your ISP provides you with their DNS server addresses, you can assign them to each PC by modifying the PCs' IP properties.
- **Dynamically from a DHCP pool:** You can configure the DHCP Server feature on the ADSL/Ethernet router and create an address pool that specify the DNS addresses to be distributed to the PCs. Refer to Chapter 7, ¡Configuring DHCP Server¡¨ on page 43 for instructions on creating DHCP address pools.

In either case, you can specify the actual addresses of the ISP's DNS servers (on the PC or in the DHCP pool), or you can specify the address of the LAN port on the ADSL/Ethernet router (e.g., 192.168.1.1). When you specify the LAN port IP address, the device performs *DNS relay*, as described in the following section.

Note

Configuring DNS Relay

When you specify the device's LAN port IP address as the DNS address, then the ADSL/Ethernet automatically performs ¡§DNS relay¡¨; i. e, because the device itself is not a DNS server, it forwards domain name lookup requests from the LAN PCs to a DNS server at the ISP. It then relays the DNS server¡¦s response to the PC.

When performing DNS relay, the ATU-R110 must maintain the IP addresses of the DNS servers it contacts. It can learn these addresses in either or both of the following ways:

- **Learned through PPP:** If the device uses a PPP connection to the ISP, the primary and secondary DNS addresses can be learned via the PPP protocol. To use this method, the "Use DNS" checkbox must be selected in the PPP interface properties. (See Chapter 13 for instructions on configuring your PPP interface. Note that you cannot change this property by modifying an existing PPP interface; you must delete the interface and recreate it with the new setting.)

  Using this option provides the advantage that you will not need to reconfigure the PCs or the ADSL/Ethernet router if the ISP changes their DNS addresses.

- **Configured on the ADSL/Ethernet router:** You can use the device's DNS feature to specify the ISP's DNS addresses. If the device also uses a PPP interface with the "Use DNS" property enabled, then these configured addresses will be used in addition to the two addresses learned through PPP. If "Use DNS" is not enabled, or if a protocol other than PPP is used (such as EoA), then these configured addresses will be used as the primary and secondary DNS addresses.

Follow these steps to configure DNS relay:

1. Configure the LAN PCs to use the ADSL/Ethernet router's LAN IP address as their DNS server address¡¦ by assigning the LAN IP address statically to each PC, or by inputting the LAN IP address or the address 0.0.0.0 as the DNS address in the DHCP server pool used by the PCs.
2. If using a PPP connection to the ISP, click the "Use DNS" check box so that the DNS server addresses it learns are used for DNS relay.

   Or, ...

   If not using a PPP connection (or if you want to specify DNS addresses in addition to those learned through PPP), configure the DNS addresses on the ADSL/Ethernet router as follows:

a. Click the Services tab, and then click **DNS** in the task bar. The DNS Configuration page displays.

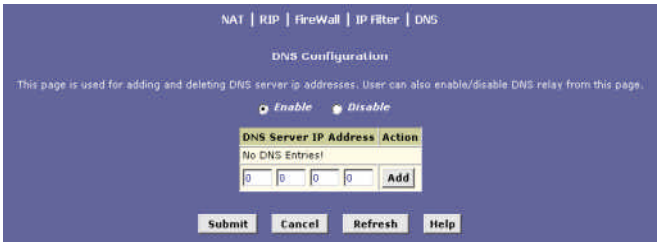


Figure 27. DNS Configuration Page

b. Type the IP address of the DNS server in an empty row and click Add.

You can enter only two addresses.

c. Click the **Enable** radio button, and then click Submit.

3. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

4. Click Commit to save your changes to permanent memory.

Note

DNS addresses that are assigned to LAN PCs prior to enabling DNS relay will remain in effect until the PC is rebooted. DNS relay will only take effect when a PC's DNS address is the LAN IP address.

Similarly, if after enabling DNS relay, you specify a DNS address (other than the LAN IP address) in a DHCP pool or statically on a PC, then that address will be used instead of the DNS relay address.

10 Configuring IP Routes

You can use Configuration Manager to define specific routes for your Internet and network data. This chapter describes basic routing concepts and provides instructions for creating routes.

Note that most users do not need to define IP routes.

Overview of IP Routes

The essential challenge of a router is: when it receives data intended for a particular destination, which next device should it send that data to?. When you define IP routes, you provide the rules that a computer uses to make these decisions.

Comparing IP routing to telephone switching

IP routing decisions are similar to those made by switchboards that handle telephone calls.

When you dial a long distance telephone number, you are first connected to a switchboard operated by your local phone service carrier. All calls you initiate go first to this main switchboard.

If the phone number you dialed is outside your calling area, the switchboard opens a connection to a higher-level switchboard for long distance calls. That switchboard looks at the area code you dialed and connects you with another switchboard that serves that area. This new switchboard, in turn, may look at the prefix in the number you dialed (the middle set of three numbers) and connect to a more localized switchboard that handles numbers with that prefix. This final switchboard can then look at the last four digits of the phone number to open a connection with the person or company you dialed.

In comparison, when your computer initiates communication over the Internet, such as viewing a web page connecting to an web server, the data it sends out includes the IP address of the destination computer (the ¡§phone number¡¨). All your outgoin requests first go to the same router at your ISP (the first ¡§switchboard¡¨). That router looks at the network ID portion the destination address (the ¡§area code¡¨) and determines which nex router to send the request to. After several such passes, the request arrives at a router for the destination network, which then uses the host ID portion of the destination IP address (the local ¡§phone number¡¨) to route your request to the appropriate computer. (The network ID and host ID portions of IP addresses are explained in Appendix 0..)

With both the telephone and the computer, all transactions are initially sent to the same switchboard or router, which serves as a gateway to other higher- or lower-level devices. No single device knows at the outset the eventual path the data will take, but each uses a specific part of the destination address/phone number to make a decision about which device to connect to next.

Hops and gateways

Each time Internet data is passed from one Internet address to another, it is said to take a *hop*. A hop can be a handoff to a different port on the same device, to a different device on the same network, or to a device on an entirely different network.

When a hop passes data from one type of network to another, it uses a *gateway*. A gateway is an IP address that provides initial access to a network, just as a switchboard serves as a gateway to a specific set of phone numbers. For example, when a computer on your LAN requests access to a company's web site, your ISP serves as a gateway to the Internet. As your request reaches its destination, another gateway provides access to the company's web servers.

Using IP routes to define default gateways

IP routes are defined on computers, routers, and other IP-enabled devices to instruct them which hop to take, or which gateway to use, to help forward data along to its specified destination.

If no IP route is defined for a destination, then IP data is passed to a predetermined *default gateway*. The default gateway serves like a higher-level telephone switchboard; it may not be able to connect directly to the destination, but it will know a set of other devices that can help pass the data intelligently. If it cannot determine which of these devices provides a good next hop (because no such route has been defined), then that device will forward the data to *its* default gateway. Eventually, a high level device, using a predefined IP route, will be able to forward the data along a path to its destination.

Do I need to define IP routes?

Most users do not need to define IP routes. On a typical small home or office LAN, the existing routes that set up the default gateways for your LAN computers and for the ATU-R110 provide the most appropriate path for all your Internet traffic.

- On your LAN computers, a default gateway directs all Internet traffic to the LAN port on the ATU-R110. Your LAN computers know their default gateway either because you assigned it to them when you modified their TCP/IP properties, or because you configured them to receive the information dynamically from a server whenever they access the Internet. (Each of these processes is described in the Quick Start instructions, Part 2.)
- On the ATU-R110 itself, a default gateway is defined to direct all outbound Internet traffic to a router at your ISP. This default gateway is assigned automatically by your ISP whenever the device negotiates an Internet connection. (The process for adding a default route is described on page 77.)

You may need to define routes if your home setup includes two or more networks or subnets, if you connect to two or more ISP services, or if you connect to a remote corporate LAN.

Viewing the IP Routing Table

All IP-enabled computers and routers maintain a table of IP addresses that are commonly accessed by their users. For each of these *destination IP addresses*, the table lists the IP address of the first hop the data should take. This table is known as the device¡¦s *routing table*.

To view the ATU-R110¡¦s routing table, click the Routing tab. The IP Route page displays by default, as shown in Figure 28:

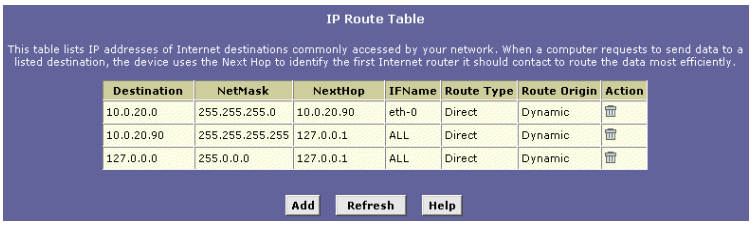


Figure 28. IP Route Table Page

The IP Route Table displays a row for each existing route. These include routes that were predefined on the device, routes you may have added, and routes that the device has identified automatically through communication with other devices.

The routing table should reflect a default gateway, which directs outbound Internet traffic to your ISP. This default gateway is shown in the row containing destination address 0.0.0.0.

The following table defines the fields in the IP Routing Table.

Field	Description
Destination	Specifies the IP address of the destination computer. The destination can specified as the IP address of a specific computer or an entire network. It can also be specified as all zeros to indicate that this route should be used for all destinations for which no other route is defined (this is the route that creates the default gateway).
Netmask	Indicates which parts of the destination address refer to the network and which parts refer to a computer on the network. Refer to Appendix 0, for an explanation of network masks. The default gateway uses a netmask of 0.0.0.0.
NextHop	Specifies the *next* IP address to send data to when its final destination is that shown in the destination column.
IFName	Displays the name of the interface on the device through which data is forwarded to the specified next hop.
Route Type	Displays whether the route is direct or indirect. In a *direct* route, the source and destination computers are on the same network, and the router attempts to directly deliver the data to the computer. In an *indirect* route, the source and destination computers are on different networks, and the router forwards data to a device on another network for further handling.
Route Origin	Displays how the route was defined. *Dynamic* indicates that the route was created automatically or predefined by your ISP or the manufacturer. Routes you create are labeled *Local*. Other routes can be created automatically (using RIP, as described in Chapter 9), or defined remotely through various network management protocols (LCL or ICMP).
Action	Displays an icon ( ) you can click on to delete a route.

Adding IP Routes

Follow these instructions to add an IP route to the routing table.

1. From the IP Route Table page, click **Add**.

   The IP Route ¡ Add page displays, as shown in Figure 29.

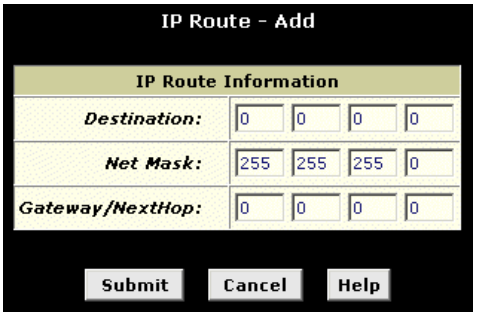


   Figure 29. IP Route ¡ Add Page

2. Specify the destination, network mask, and gateway or next hop for this route.

   For a description of these fields, refer to the table on page 76.

   To create a route that defines the default gateway for your LAN, enter 0.0.0.0 in both the Destination and Net Mask fields. Enter your ISP¡¦s IP address in the Gateway/ Next Hop field.

   Note that you cannot specify the interface name, route type or route origin. These parameters are used only for routes that are identified automatically as the device communicates with other routing devices. For routes you create, the routing table displays system default values in these fields.

3. Click **Submit**.

4. On the confirmation page, click **Close** to return to the IP Route table page.

The IP Routing Table will now display the new route.

5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

6. Click **Commit** to save your changes to permanent memory.

11 Configuring the Routing Information Protocol

The ATU-R110 can be configured to communicate with other routing devices to determine the best path for sending data to its intended destination. Routing devices communicate this information using a variety of IP protocols. This chapter describes how to configure the ATU-R110 to use one of these, called the Routing Information Protocol (RIP).

RIP Overview

RIP is an Internet protocol you can set up to share routing table information with other routing devices on your LAN, at your ISP's location, or on remote networks connected to your network via the ADSL line. Generally, RIP is used to enable communication on *autonomous* networks. An autonomous network is one in which all of the computers are administered by the same entity. An autonomous network may be a single network, or a grouping of several networks under the same administration. An example of an autonomous network is a corporate LAN, including devices that can access it from remote locations, such as the computers telecommuters use.

Using RIP, each device sends its routing table to its closest neighbor every 30 seconds. The neighboring device in turn passes the information on to its next neighbor and so on until all devices in the autonomous network have the same set of routes.

When should you configure RIP?

Most small home or office networks do not need to use RIP; they have only one router, such as the ATU-R110 and one path to an ISP. In these cases, there is no need to share routes, because all Internet data from the network is sent to the same ISP gateway.

You may want to configure RIP if any of the following circumstances apply to your network:

- Your home network setup includes an additional router or RIP-enabled PC (other than the ATU-R110). The ATU-R110 and the router will need to communicate via RIP to share their routing tables.
- Your network connects via the ADSL line to a remote network, such as a corporate network. In order for your LAN to learn the routes used within your corporate network, they should *both* be configured with RIP.
- Your ISP requests that you run RIP for communication with devices on their network.

Configuring the ATU-R110¡¦s Interfaces with RIP

The following instructions describe how to enable RIP on the ATU-R110.

Note

In order for the ATU-R110 to communicate with other devices using RIP, you must also enable the other devices to use the protocol. See the product documentation for those devices.

1. Log into the Configuration Manager, click the Services tab, and then click **RIP** in the task bar.

   The RIP Configuration page displays, as shown in Figure 30.

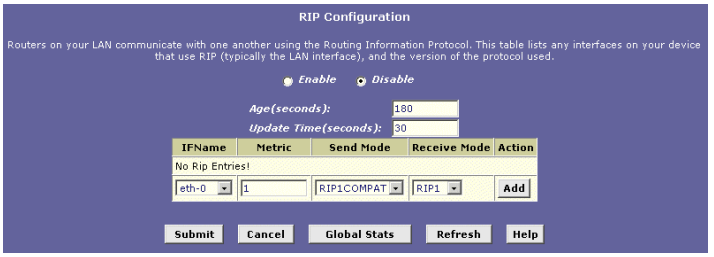


Figure 30. RIP Configuration Page

   The page contains radio buttons for enabling or disabling the RIP feature and a table listing interfaces on which the protocol is currently running. The first time you open this page, the table may be empty.

2. If necessary, change the Age and Update Time.

   These are global settings for all interfaces that use RIP.

   - *Age* is the amount of time in seconds that the device¡¦s RIP table will retain each route that it learns from adjacent computers.
   - *Update Time* specifies how frequently the ATU-R110 will send out its routing table its neighbors.

3. In the IFName column, select the name of the interface on which you want to enable RIP.

   For communication with RIP-enabled devices on your LAN, select eth-0 or the name of the appropriate virtual Ethernet interface.

   For communication with your ISP or a remote LAN, select the corresponding ppp, eoa, or other WAN interface.

   (See page 39 for a description of various interfaces and their names.)

4. Select a metric value for the interface.

   RIP uses a ¡§hop count¡¨ as a way to determine the best path to a given destination in the network. The hop count is the sum of the metric values assigned to each port through which data is passed before reaching the destination. Among several

alternative routes, the one with the lowest hop count is considered the fastest path.

For example, if you assign this port a metric of 1, then RIP will add 1 to the hop count when calculating a route that passes through this port. If you know that communication via this interface is slower than through other interfaces on your network, you can assign it a higher metric value than the others.

You can select any integer from 1 to 15.

5. Select a Send Mode and a Receive Mode.

   The Send Mode setting indicates the RIP version this interface will use when it sends its route information to other devices.

   The Receive Mode setting indicates the RIP version(s) in which information must be passed to the ATU-R110 in order for it to be accepted into its routing table.

   RIP version 1 is the original RIP protocol. Select RIP1 if you have devices that communicate with this interface that understand RIP version 1 only.

   RIP version 2 is the preferred selection because it supports ¡§d ass¢ ess¡¨ laddresses (which are used to create subnets) and other features. Select RIP2 if all other routing devices on the autonomous network support this version of the protocol.

6. Click **Add**.

   The new RIP entry will display in the table.

7. Click the **Enable** radio button to enable the RIP feature.

Note

If you disable the RIP feature, the interface settings you have configured will remain available for future activation.

8. When you are finished defining RIP interfaces, click **Submit**.

   A page displays to confirm your changes.

9. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

10. Click **Commit** to save your changes to permanent memory.

Note

You can delete an existing RIP entry by clicking in the Action column.

Viewing RIP Statistics

From the RIP Configuration page, you can click Global Stats to view statistics on attempts to send and receive route table data over RIP-enabled interfaces on the ATU-R110.

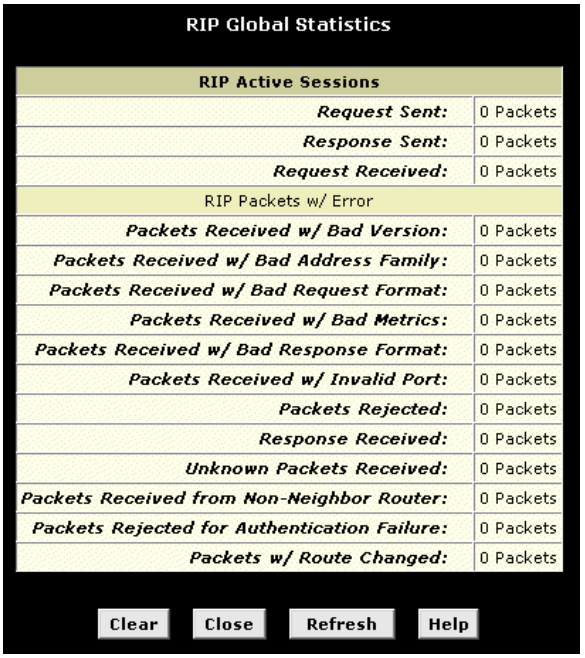

RIP Global Statistics
RIP Active Sessions
Request Sent: 0 Packets
Response Sent: 0 Packets
Request Received: 0 Packets
RIP Packets w/ Error
Packets Received w/ Bad Version: 0 Packets
Packets Received w/ Bad Address Family: 0 Packets
Packets Received w/ Bad Request Format: 0 Packets
Packets Received w/ Bad Metrics: 0 Packets
Packets Received w/ Bad Response Format: 0 Packets
Packets Received w/ Invalid Port: 0 Packets
Packets Rejected: 0 Packets
Response Received: 0 Packets
Unknown Packets Received: 0 Packets
Packets Received from Non-Neighbor Router: 0 Packets
Packets Rejected for Authentication Failure: 0 Packets
Packets w/ Route Changed: 0 Packets
Clear
Close
Refresh
Help

Figure 31. RIP Global Statistics Page

You can click Clear to reset all statistics to 0 and Refresh to display any newly accumulated data.

12 Configuring the ATM VCC

As your LAN computers access the Internet via the ATU-R110, data is exchanged with your ISP through a complex network of telephone switches, Internet routers, servers, and other specialized hardware. These various devices communicate using a common language, or protocol, called *Asynchronous Transfer Mode* (ATM). On the Wide Area Network (WAN) that connects you to your ISP, the ATM protocol performs functions like those that the Ethernet protocol performs on your LAN.

This chapter describes how to configure the ATM *virtual channel connection* (VCC). The VCC properties define the path the ATU-R110 uses to communicate with your ISP over the ATM network.

Viewing Your ATM VC Setup

To view your current configuration, log into Configuration Manager, click the WAN tab, and then click **ATM VCC** in the task bar. The ATM VCC Configuration page displays, as shown in Figure 32.

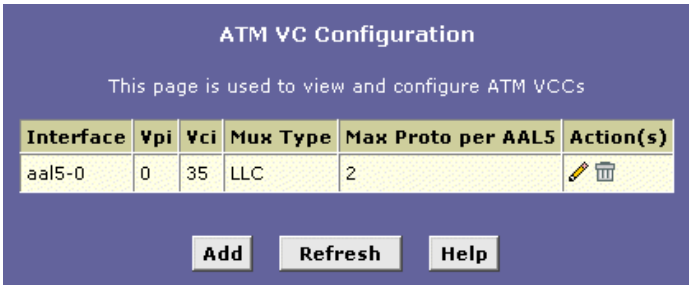


Figure 32. ATM VCC Configuration Page

The ATM VCC Configuration table displays the following fields (contact your ISP to determine these settings):

Field	Description
Interface	The name of the lower-level interface on which this VC operates. The low-level interface names are preconfigured in the software and identify the type of traffic that can be supported, such as data or voice. Internet data services typically use an AAL5-type interface.
Vpi, Vci, and Mux Type	These settings identify a unique ATM data path for communication between your ADSL/Ethernet router and your ISP.
Max Proto per AAL5	If you are using an AAL5-type of interface, this setting indicates the number of higher-level interfaces that the VC can support (the higher level interfaces can be PPP, EoA, or IPoA interfaces). Contact your ISP to determine which connection protocol(s) they require.
Actions	Displays an icon ( ) you can click on to delete the associated interface.

Adding ATM VCCs

You may need to create a VCC if none has been predefined on your system or if you use multiple services with your ISP. Each service may require its own VCC. Follow these instructions to add a VCC:

1. From the ATM VCC Configuration page, click **Add**.

   The ATM VCC ¡ Add page displays, as shown in Figure 33.

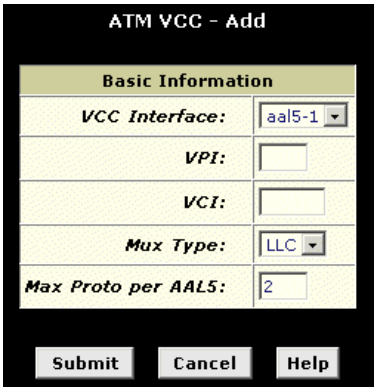


Figure 33. ATM VCC ¡ Add Page

2. Select an interface name from the VCC Interface drop-down list.
3. Enter the VPI and VCI values assigned by your ISP, and select the mux type from the drop-down list.
4. Click Submit.
5. On the confirmation page, click Close to return to the ATM VCC Configuration page.
6. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
7. Click Commit to save your changes to permanent memory.

   The new interface should now display in the ATM VCC Configuration table.

You may need to create a new WAN interface, or modify an existing interface, so that it uses the new VCC. See the instructions for configuring a PPP (Chapter 12), EoA (Chapter 14), or IPoA (Chapter 15) interfaces, depending on the type you use to communicate with your ISP.

You can verify that the new settings work by attempting to access the Internet from a LAN/USB computer. Contact your ISP for troubleshooting assistance.

Modifying ATM VCCs

Your device may already be preconfigured with the necessary ATM VCC properties, or the table may contain placeholder values that you must change before using the device. Contact your ISP to determine your ATM VCC values. Follow these instructions to modify a preconfigured VCC:

1. From the ATM VCC Configuration page, click in the Actions column for the interface you want to modify.

   The ATM VCC Interface ¡ Modify page displays, as shown in Figure 33.

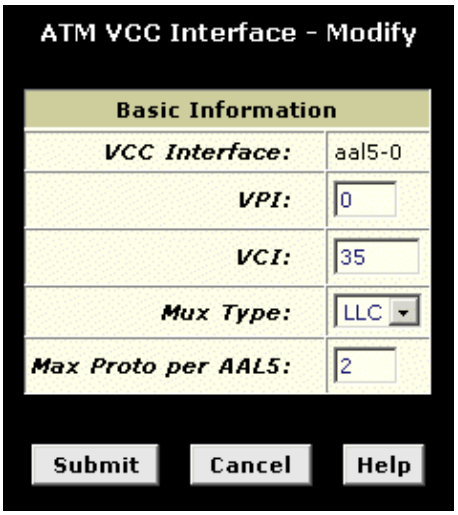


Figure 34. ATM VCC Interface ¡ Modify Page

2. Enter the new VPI and VCI values, select the MUX type, or change the maximum number of protocols that the VCC can carry, as directed by your ISP.

   You cannot modify the interface type over which an existing VCC operates (aal5-0, for example). If you want to change the interface type, you must delete the existing interface, create a new one, and select the desired interface type.

3. Click **Submit**.

4. On the confirmation page, click **Close** to return to the ATM VCC Configuration page.

5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

6. Click **Commit** to save your changes to permanent memory.

You can verify that the new settings work by attempting to access the Internet from a LAN/USB computer. Contact your ISP for troubleshooting assistance.

13 Configuring PPP Interfaces

When powered on, the ATU-R110 initiates a connection through your DSL line to your ISP.

The point-to-point (PPP) protocol is commonly used between ISPs and their customers to identify and control various communication properties, including:

- Identifying the type of service the ISP provides to a given customer
- Identifying the customer to the ISP through a username and password login
- Enabling the ISP to assign Internet information to the customer¡¦s co mput er

Your ISP may or may not use the PPP protocol. Contact your ISP to determine if you will need to change the default settings in order to connect to their server.

Viewing Your Current PPP Configuration

To view your current PPP setup, log into Configuration Manager, click the WAN tab, and then click **PPP** in the task bar. The PPP Configuration page displays, as shown in Figure 35.

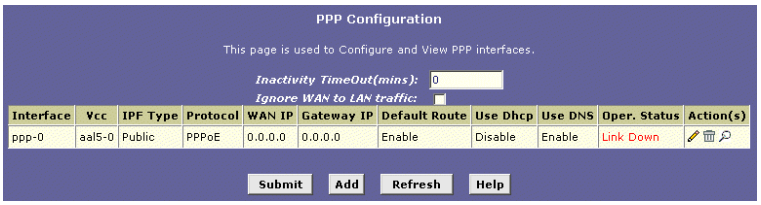


Figure 35. PPP Configuration Page

PPP is configured as a group of software settings associated with the ADSL port. Although the device has only one physical ADSL port, the ATU-R110 can be defined with more than one group of PPP settings. Each group of settings is called a *PPP interface* and is given a name, such as *ppp-0*, *ppp-1*, etc.

You can configure the following settings on the PPP Configuration page:

- **Inactivity Time Out (mins)**: The time in minutes that must elapse before a PPP connection times-out due to inactivity.
- **Ignore WAN to LAN traffic**: When enabled, data traffic traveling in the incoming direction¡ from the WAN port to the LAN port¡ will not count as activity on the WAN port; i.e., it will not prevent the connection from being terminated if inactive for the specified time.

The PPP Configuration Table displays the following fields:

Field	Description
Interface	The predefined name of the PPP interface.
VCC	The Virtual Channel Connection over which this PPP data is sent. The VCC identifies the physical path the data takes to reach your ISP. See Chapter 12 for more information.
IPF Type	The type of IP Firewall protections that are in effect on the interface (public, private, or DMZ): o A public interface connects to the Internet (PPP interfaces are typically public). Packets received on a public interface are subject to the most restrictive set of firewall protections defined in the software. o A private interface connects to your LAN, such as the Ethernet interface. Packets received on a private interface are subject to a less restrictive set of protections, because they originate within the network. o The term DMZ (de-militarized zone), in Internet networking terms, refers to computers that are available for both public and in-network accesses (such as a company's public Web server). Packets incoming on a DMZ interface -- whether from a LAN or external source -- are subject to a set of protections that is in between public and private interfaces in terms of restrictiveness.
Protocol	The type of PPP protocol used. Your ISP may use PPP-over-Ethernet (PPoE) or PPP-over-ATM (PPoA).
WAN IP	The IP address currently assigned to your WAN (DSL) port by your ISP.
Gateway IP	The IP address of the server at your ISP that provides you access to the Internet. See ¡ Hops and gateways¡¨ on page 74 for a description of gateway addresses.
Default Route	Indicates whether the ADSL/Ethernet router should use the IP address assigned to this connection as its default route. Can be Enabled or Disabled. See Chapter 10 for an explanation of default routes.

Field	Description
Use DHCP	When set to *Enable*, the device will acquire additional IP information from the ISP's DHCP server. The PPP connection itself acquires the device's IP address, mask, DNS address, and default gateway address. With Use DHCP enabled, the device will acquire IP addresses for various other server types (WINS, SMTP, POP3, etc. -- these server types are listed on the DHCP Server Configuration page).
User DNS	When set to *Enable*, the DNS address learned through the PPP connection will be distributed to clients of the device's DHCP server. This option is useful only when the ADSL/Ethernet Router is configured to act as a DHCP Server for your LAN. When set to *Disable*, LAN hosts will use the DNS address(es) preconfigured in the DHCP pool (see ¡Configuring DHCP Server¡¨ on page43) and in the DNS feature (see Chapter 9, ¡Configuring DNS Server Addresses¡¨)
Oper. Status	Indicates whether the link is currently up or down or if a specific type of data exchange is under way (e.g., password authorization or DHCP).
Actions	You can use these icons to modify ( ), delete ( ), and view additional details on ( ) the PPP interface.

Viewing PPP Interface Details

When you click to view additional details, the PPP Interface - Detail page displays, as shown in Figure 36.

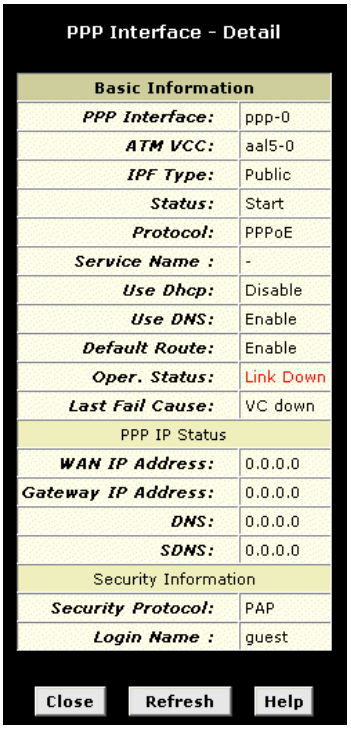


Figure 36. PPP ¡ Detail Page

In addition to the properties defined on page 88, the Detail page displays these fields:

Field	Description
Status	Indicates whether the interface has been specified in the system as: o Enabled: A connection will be established for use when the device is turned on or rebooted. o Disabled: The PPP interface cannot currently be used. o Start On Data: The PPP connection will be made only when data is sent to the interface (e.g., when a LAN user attempts to use the Internet).
Service Name	The name of the ISP service you are using with this PPP connection. ISPs may offer different types of services (for example, for online gaming or business communications), each requiring a different login and other connection properties.

Field	Description
Last Fail Cause	Indicates the action that ended the previous PPP session: o No Valid PADO Recvd: The unit initiated a PPoE handshake but did not receive a packet in reply from the ISP. o No Valid PADS Recvd: After the initial handshake, the unit did not receive a confirmation packet from the ISP. o Stopped by User: The user stopped the connection (for example, by changing the Configuration Manager settings for the PPP interface.) o No Activity: The PPP communication timed out, in accordance with the timeout period specified on the PPP Configuration page. o Auth Failure: The ISP could not authorize the connection based on the user name and/or password provided. o PADT recvd: The ISP issued a special packet type to terminate the PPP connection. o VC down: The Virtual Circuit between the unit and the ISP is down. o Internal failure: A system software failure occurred.
DNS	The IP address of the DNS server (located with your ISP) used on this PPP connection.
SDNS	The IP address of the secondary DNS server (located with your ISP) used on this PPP connection.
Security Protocol	The type of PPP security your ISP uses: *PAP* (Password Authentication Protocol) or *CHAP* (Challenge Handshake Authentication Protocol).
Login Name	The name you use to log in to your ISP each time this PPP connection is established.

Adding a PPP Interface Definition

If you intend to use more than one type of service from your ISP, the device may be configured with multiple PPP interfaces, each with unique logon and other properties. Follow this procedure to define properties for a PPP interface:

1. From the PPP Configuration Page, click **Add**.

   The PPP Interface ¡ Add page displays, as shown in Figure 37.

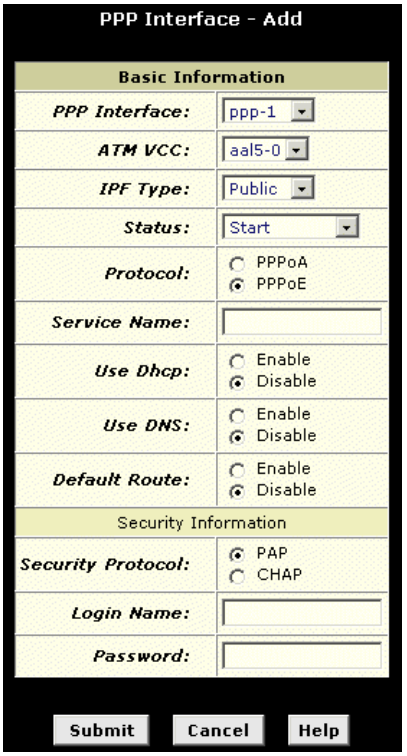


Figure 37. PPP Interface ¡ Add Page

2. Select a PPP interface name from the drop-down list, and then enter or select data for each field.

Note

You can create multiple PPP interfaces only if you are using the PPoA protocol; only one PPP interface can be define if you are using PPoE. Check with your ISP which version of the protocol they require.

The fields are defined in the tables on page 88 and 11.

3. Click **Submit**.

   A page displays to confirm your changes.

4. Click **Close** to return to the PPP page and view the new interface in the table.

5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

6. Click Commit to save your changes to permanent memory.

Modifying and Deleting PPP Interfaces

To modify a PPP interface, display the PPP Configuration page and click in the Action(s) column for the interface you want to modify. The PPP Interface ¡ Modify page displays, as shown in Figure 38.

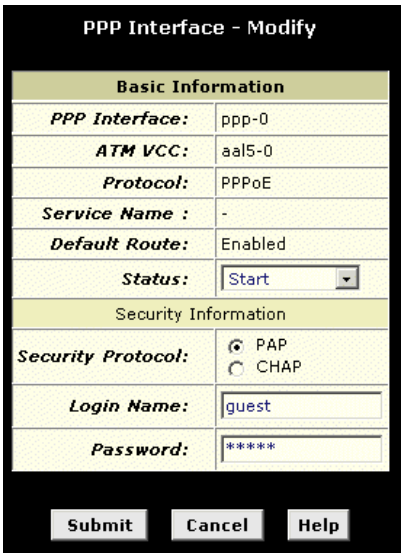


Figure 38. PPP Interface ¡ Modify

You can change only the status of the PPP connection, the security protocol, your login name, and your password. To modify the other settings, you must delete the interface and create a new one.

To delete a PPP interface, display the PPP Configuration page and click in the Action(s) column for the interface you want to delete. You should not delete a PPP interface unless you have received instructions to do so from your ISP. Without an appropriately defined PPP interface, you will not be able to connect to your ISP. You can recreate the PPP interface with the same name at a later time.

After modifying or deleting a PPP interface, click Submit. Then, Click the Admin tab, click **Commit & Reboot** in the task bar, and click Commit to save your changes to permanent memory.

14 Configuring EOA Interfaces

This chapter describes how to configure an Ethernet-over-ATM interface on the ATU-R110, if one is needed to communicate with your ISP.

Overview of EOA

The Ethernet-over-ATM (EOA) protocol is commonly used to carry data between local area networks that use the Ethernet protocol and wide-area networks that use the ATM protocol. Many telecommunications industry networks use the ATM protocol. ISPs who provide DSL services often use the EOA protocol for data transfer with their customers¡¦ DSL modems.

EOA can be implemented to provide a bridged connection between a DSL modem and the ISP. In a bridged connection, data is shared between the ISP¡¦s network and their customers as if the network were on the same physical LAN. Bridged connections do not use the IP protocol. EOA can also be configured to provide a routed connection with the ISP, which uses the IP protocol to exchange data.

Before creating an EOA interface or modifying the default settings, contact your ISP to determine which type of protocol they use.

Note

PPP vs. EOA: *Your ISP may use a protocol other than EOA for communication with the ATU-R110, such as the point-to-point protocol (PPP). One type of PPP, named PPP over Ethernet (PPPoE), actually works ¡§on top of¡¨ the EOA protocol. The other type, PPP over ATM (PPPoA), does not. However, if your ISP uses either type of PPP, you* ***do not*** *need to separately create an EOA interface. See Chapter 12 for instructions on creating or configuring a PPP interface.*

Viewing Your EOA Setup

To view your current EOA configuration, log into Configuration Manager, click **Advanced** in the task bar, and then click **EOA**. Figure 39 shows the EOA configuration page.

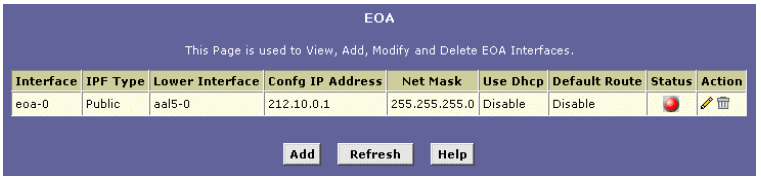


Figure 39. EOA Page

The EOA table contains a row for each EOA interface currently defined on the device. The table may contain no entries if your ISP does not use the EOA protocol.

The following table describes the fields on this page:

Field	Description
Interface	The name the software uses to identify the EOA interface.
IPF Type	The type of IP Firewall protections in effect on the interface (public, private, or DMZ): o A *public* interface connects to the Internet (IPoA interfaces are typically public). Packets received on a public interface are subject to the most restrictive set of firewall protections defined in the software. o A *private* interface connects to your LAN, such as the Ethernet interface. Packets received on a private interface are subject to a less restrictive set of protections, because they originate within the network. o The term *DMZ* (de-militarized zone), in Internet networking terms, refers to computers that are available for both public and in-network accesses (such as a company's public Web server). Packets incoming on a DMZ interface¡ whether from a LAN or external source¡ are subject to a level of protection that is in between those for public and private interfaces.
Lower interface	EOA interfaces are defined in software, and then associated with lower-level software and hardware structures (at the lowest level, they are associated with a physical port ¡ the WAN port). This field should reflect an interface name defined in the next lower level of software over which the EOA interface will operate. This will be an ATM VCC interface, such as *aal5-0*, as described in Chapter 12.

Field	Description
Config IP Address and Net Mask	The IP address and network mask you want to assign to the interface. If the interface will be used for bridging with your ISP and you will not be using the ATU-R110 as a router on your LAN, then you do not need to specify IP information. If you enable DHCP for this interface, then the Configured IP address will serve only as a request to the DHCP server. The actual address that is assigned by the ISP may differ if this address is not available.
Use DHCP	When checked, this setting instructs the device to accept IP information assigned dynamically by your ISP¡¦s DHCP server. If the interface will be used for bridging with your ISP and you will not be routing data through it, leave this checkbox unselected.
Default Route	Indicates whether the ATU-R110 should use the IP address assigned to this interface, if any, as its default route for your LAN. This can be *Enable* or *Disable*. See Chapter 9 for an explanation of default routes.
Status	A green or red ball will display to indicate that the interface is currently up or down, respectively. You cannot manually enable or disable the interface; a red ball may indicate a problem with the DSL connection.
Action	Icons you can click on to edit ( ) or delete ( ) the associated EOA interface.

Adding EOA Interfaces

Follow these instructions to add an EOA interface:

1. Click the WAN tab, and then click **EOA** in the task bar.
2. Click Add.

   The EOA Interface ¡ Add page displays, as shown in Figure 40.

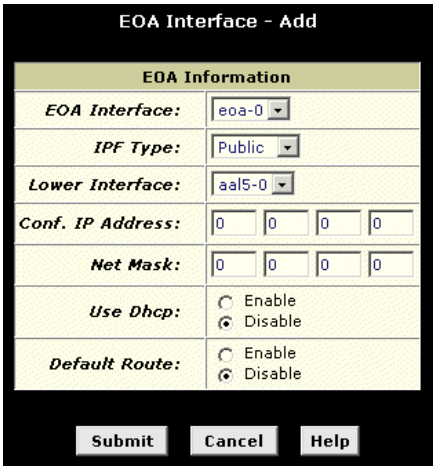


Figure 40. EOA Interface ¡ Add Page

3. Select one of the predefined interface names from the EOA Interface drop down list.

4. From the IPF Type drop-down list, select the level of IP Firewall to be used on this interface, as defined above.
5. In the Lower Interface field, select the lower-level interface name over which this protocol is being configured. Typically, an EOA interface is configured to operate over an aal5 interface, such as *aal5-0*.

   If you are using the ATU-R110 as a bridge only, skip to step 7.
6. If you are using the ATU-R110 as a router on your LAN, enter the IP address and network mask you want to assign to the interface. This address serves as the public IP address for your entire LAN and is usually assigned by your ISP.

   Or, if your ISP will assign this information, click the Enable radio button to set up the DHCP service.

   Also, specify whether this interface should serve as the default route for your LAN for accessing the Internet.
7. Click

.

   A confirmation page display to confirm your changes.
8. Click

to return to the EOA page and view the new interface in the table.
9. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
10. Click

to save your changes to permanent memory.

15 Configuring IPoA Interfaces

This chapter describes how to configure an IPoA (Internet Protocol-over-ATM) interface on the ATU-R110.

An IPoA interface can be used to exchange IP packets over the ATM network, without using an underlying Ethernet over ATM (EOA) connection. Typically, this type of interface is used only in product development and test environments, to eliminate unneeded variables when evaluating IP layer processing.

Viewing Your IPoA Interface Setup

To configure an IPoA interface, log into Configuration Manager, click the WAN tab, and then click **IPoA** in the task bar. The IPoA page displays, as shown in Figure 41.

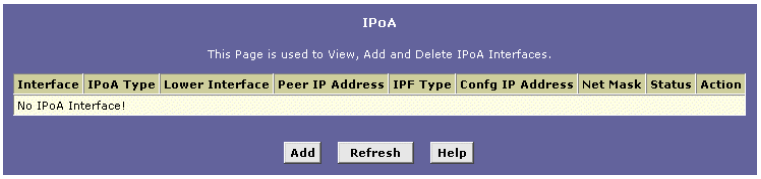


Figure 41. IPoA Page

The IPoA table contains a row for each EOA interface currently defined on the device. The table may initially contain no entries.

The following table describes the fields on this page:

Field	Description
Interface	The name the software uses to identify the IPoA interface
IPoA Type	Specifies whether or not the IPoA protocol to be used complies with the IEFT RFC 1577 "Classical IP and ARP over ATM" (contact your ISP if unsure).
Lower interface	IPoA interfaces are defined in software, and then associated with lower-level software and hardware structures (at the lowest level, they are associated with a physical port ¡ the WAN port). This field should reflect an interface name defined in the next lower level of software over which the IPoA interface will operate. This will be an ATM VCC interface, such as *aal5-0*, as described in Chapter 12.
Peer IP Address	The IP address of the remote computer you will be connecting to via the WAN interface.

Field	Description
IPF Type	The type of IP Firewall protections that are in effect on the interface (public, private, or DMZ): o A *public* interface connects to the Internet (IPoA interfaces are typically public). Packets received on a public interface are subject to the most restrictive set of firewall protections defined in the software. o A *private* interface connects to your LAN, such as the Ethernet interface. Packets received on a private interface are subject to a less restrictive set of protections, because they originate within the network. o The term *DMZ* (de-militarized zone), in Internet networking terms, refers to computers that are available for both public and in-network accesses (such as a company's public Web server). Packets incoming on a DMZ interface¡ whether from a LAN or external source¡ are subject to a level of protection that is in between those for public and private interfaces.
Config IP Address and Net Mask	The IP address and network mask you want to assign to the interface.
Status	A green or red ball will display to indicate that the interface is currently up or down, respectively. You cannot manually enable or disable the interface; a down interface may indicate a problem with the DSL connection.
Action	Icons you can click on to edit ( ) or delete ( ) the associated EOA interface.

Adding IPoA Interfaces

Follow these instructions to add an IPoA interface:

1. Display the IPoA page and click **Add**.

   The IPoA Interface ¡ Add page displays, as shown in Figure 42.

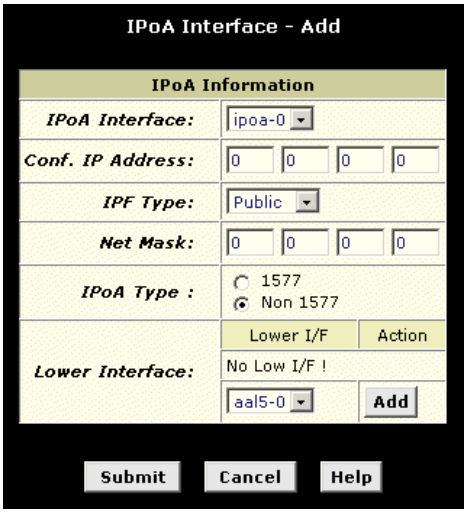


Figure 42. IPoA Interface ¡ Add Page

2. Select the next available interface name from the IPoA Interface drop-down list.
3. In the Configured IP Address and Net Mask boxes, type the address and mask that you want to assign to the IPoA interface.
4. Select the level of firewall security to apply to the interface by selecting the IPF Type as Public, Private, or DMZ.
5. In the Lower Interface dialog box, select the lower-level interface name over which this protocol is being configured and click **Add**.

   Typically, an IPoA interface is configured to operate over an aal5 interface.
6. Click **Submit**.

   A confirmation page will display to confirm your changes.
7. Click **Close** to return to the EOA page and view the new interface in the table.
8. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
9. Click **Commit** to save your changes to permanent memory.

16 Configuring Bridging

The ATU-R110 can be configured to act as a bridging device between your LAN and your ISP. Bridges are devices that enable two or more networks to communicate as if they are two segments of the same physical LAN. This chapter describes how to configure the ATU-R110 to operate as a bridge.

Note

Before changing your bridge configuration, check with your ISP to determine the type of connection they use to exchange data with their customer¡¦s DSL modems (such as Ethernet bridging or IP routing).

Overview of Bridges

A bridge is a device used to connect two or more networks so they can exchange data. A bridge learns the unique manufacturer-assigned hardware IDs of each computer or device on both (or all) networks it is attached to. It learns that some of the IDs represent computers attached via one of the device's interfaces and others represent computers connected via other interfaces. For example, the hardware IDs of your home computers are attached via the Ethernet port, and the hardware IDs of your ISP's computers are attached via the WAN (DSL) port. It stores the ID list and the interface associated with each ID in its *bridge forwarding table*.

When the bridge receives a data packet, it compares its destination hardware ID to the entries in the bridge forwarding table. When the packet's ID matches one of the entries, it forwards the packet through the interface that connects to the corresponding network. Note that the bridge does not send the data directly to the receiving computer, but broadcasts it to the receiving network, making it available to any node on that network. On the receiving network, a LAN protocol such as Ethernet takes over, helping the packet reaches its destination.

When the bridge does not recognize a packet¡¦s destination hardware ID, it broadcasts the packet through all of its interfaces ¡ to each network it is attached to.

Bridges vs. Routers: *The essential difference between a bridge and a router is that a router uses a higher-level protocol (such as the IP) to determine how to pass data. IP data packets contain IP addresses that specifically identify the destination computer. Routers can read this information and pass the data to the destination computer, or determine which next router to send the data to if the destination is not on a connected network.*

Note

Bridges cannot read IP information, but instead refer to the hardware ID of the destination computer, which is also included in data packets. The hardware ID is a unique number that the manufacturer assigns to each piece of hardware it sells. A bridge learns to recognize the hardware IDs accessible through each of its ports. When it receives a packet, the bridge simply forwards the packet through the port it associates with the given hardware ID, or through all its ports if it does not recognize the ID. The hardware ID is often referred to as the Media Access Control (MAC) address.

Routers are considered more intelligent and flexible devices than bridges, and often provide a variety of security and network administration services based on the IP protocols.

Using the Bridging Feature

Although the ATU-R110 is preconfigured to serve as a router for providing Internet connectivity to you LAN, there are several instances in which you may also want to configure bridging:

- Your ISP may use protocols that require bridging with your LAN. The device can be configured to appear as a bridge when communicating with your ISP, while continuing to provide router functionality for your LAN.
- Your LAN may include computers that communicate using Layer 3 protocols other than Internet Protocol. These include IPX® and AppleTalk®. In this case, the device can be configured to act as a bridge for packets that use these protocols while continuing to serve as a router for IP data.

In both cases, you need to specify the device's interfaces as bridge interfaces.

Defining Bridge Interfaces

To enable bridging, you simply specify the device interfaces on which you want to bridge data, and then enable bridging mode:

1. Log into Configuration Manager and click the Bridging tab.

   The Bridge Configuration page displays, as shown in Figure 43.

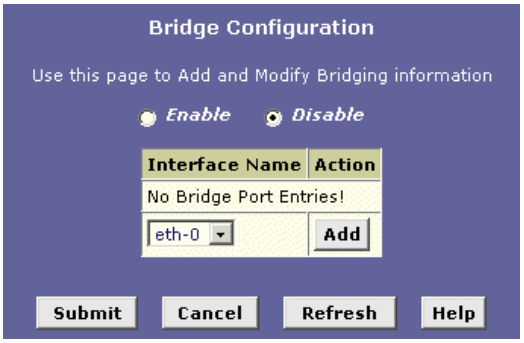


Figure 43. Bridge Configuration page

   The table may be empty if bridging has not yet been configured.

2. Select the interface names on which you want to perform bridging and click Add.

   For example, select *eth-0* (LAN) and *eoa-0* (WAN) interfaces.

Note

If you do not have an eoa-0 interface, but instead have an interface named ppp-0 *or* ipoa-0*, your device is not currently configured with a WAN interface that allows bridging with your ISP. You may want to check with your ISP to determine whether they use the eoa protocol. See Chapter 14 for instructions on creating an EOA interface.*

Note

If you enable bridging on an interface that has already been assigned an IP address, then it is considered IP-enabled and will route (rather than bridge) IP packets received on the interface. The interface will bridge non-IP data it receives, however.

You can determine whether the Ethernet (eth-0) interfaces have been assigned IP addresses by displaying the IP Address Table (display the Routing tab, and then click **IP Address***). These interfaces will display in the table only if they have been assigned IP addresses.*

You can check whether the eoa-0 interface has been assigned an IP address by displaying the EOA configuration table (click the WAN tab, and then click **EOA***). If the Config IP Address field is empty and the Use DHCP field contains the word Disable, then no IP address has been assigned.*

3. Click the **Enable** radio button to turn on bridging.

4. Click Submit.

   A page will briefly display to confirm your changes, and will return you to the Bridge Configuration page.

5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

6. Click Commit to save your changes to permanent memory.

Deleting a Bridge Interface

To make an interface non-bridgeable, display the Bridge Configuration page and click next to the interface you want to delete. Click OK to confirm the deletion. The interface remains defined in the system, but is no longer capable of performing bridging.

17 Configuring Firewall Settings

Configuration Manager provides built-in firewall functions, enabling you to protect the system against denial of service (DoS) attacks and other types of malicious accesses to your LAN. You can also specify how to monitor attempted attacks, and who should be automatically notified.

Configuring Global Firewall Settings

Follow these instructions to configure global firewall settings:

1. Log into Configuration Manager, click the Services tab, and then click **Firewall** in the task bar.

   The Firewall Configuration page displays, as shown in Figure 44.

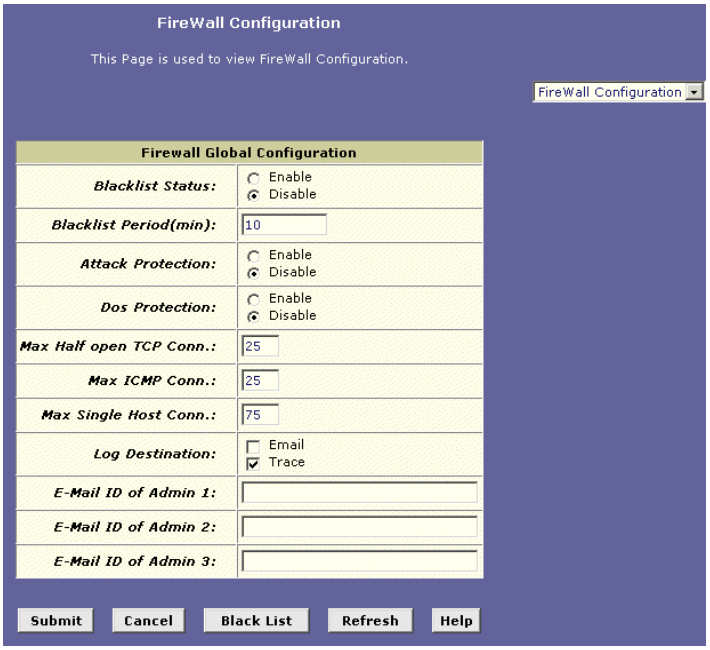


Figure 44. Firewall Configuration Page

Note that the Firewall Configuration page contains a drop-down list on the right side of the page that enables you to view firewall settings, as discussed in this chapter, or configure IP filters, as discussed in Chapter 0.

2. Configure any of the following settings that display in the Firewall Global Information table:

Field	Description
Black List Status	If you want the device to maintain and use a black list, click *Enable*. Click *Disable* if you do not want to maintain a list.
Black List Period(min)	Specifies the number of minutes that a computer's IP address will remain on the black list (i.e., all traffic originating from that computer will be blocked from passing through any interface on the ADSL/Ethernet router). For more information, see ¡ Managing the Black List¡¨ on page 110.
Attack Protection	Click the *Enable* radio button to use the built-in firewall protections that prevent the following common types of attacks: o IP Spoofing: Sending packets over the WAN interface using an internal LAN IP address as the source address. o Tear Drop: Sending packets that contain overlapping fragments. o Smurf and Fraggle: Sending packets that use the WAN or LAN IP broadcast address as the source address. o Land Attack: Sending packets that use the same address as the source and destination address. o Ping of Death: Illegal IP packet length.
DoS Protection	Click the Enable radio button to use the following denial of service protections: o SYN DoS o ICMP DoS o Per-host DoS protection
Max Half open TCP Connection	Sets the percentage of concurrent IP sessions that can be in the half-open state. In ordinary TCP communication, packets are in the half-open state only briefly as a connection is being initiated; the state changes to active when packets are being exchanged, or closed when the exchange is complete. TCP connections in the half-open state can use up the available IP sessions. If the percentage is exceeded, then the half-open sessions will be closed and replaced with new sessions as they are initiated.
Max ICMP Connection	Sets the percentage of concurrent IP sessions that can be used for ICMP messages. If the percentage is exceeded, then older ICMP IP sessions will be replaced by new sessions as the are initiated.
Max Single Host Connection	Sets the percentage of concurrent IP session that can originate from a single computer. This percentage should take into account the number of hosts on the LAN.

Field	Description
Log Destination	Specifies how attempted violations of the firewall settings will be tracked. Records of such events can be sent via Ethernet to be handled by a system utility Ethernet to (*Trace*) or can e-mailed to specified administrators.
E-mail ID of Admin 1/2/3	Specifies the e-mail addresses of the administrators who should receive notices of any attempted firewall violations. Type the addresses in standard internet e-mail address format, e.g., *jxsmith@onecompany.com*. The e-mail message will contain the time of the violation, the source address of the computer responsible for the violation, the destination IP address, the protocol being used, the source and destination ports, and the number violations occurring the previous 30 minutes. If the ICMP protocol were being used, then instead of the source and destination ports, the e-mail will report the ICMP code and type.

3. Click .
4. Click the Admin tab, and then click **Commit & Reboot** in the task bar.
5. Click to save your changes to permanent memory.

Managing the Black List

If data packets are received that violate the firewall settings or any of the IP Filter rules, then the source IP address of the offending packets can be blocked from such accesses for a specified period of time. You can enable or disable use of the black list using the settings described above. The source computer remains on the black list for the period of time that you specify.

To view the list of currently blacklisted computers, click Black List at the bottom of the Firewall Configuration page. The Firewall Blacklisted Hosts page displays, as shown in Figure 45.

Figure 45. Firewall Blacklisted Hosts Page

The table displays the following information for each entry:

Field	Description
Host IP Address	The IP address of the computer that sent the packet(s) that caused the violation
Reason	A short description of the type of violation. If the packet violated an IP Filter rule, the custom text from the Log Tag field will display. (See ¡ Creating IP Filter Rules¡¨ on page114.)
IPF Rule ID	If the packet violated an IP Filter rule, this field will display the ID assigned to the rule.
Action(s)	Displays an icon ( ) you can click on to delete the entry from the list, if you want it to be removed prior to its automatic timed expiration.

18 Configuring IP Filters

The IP filter feature enables you to create rules that control the forwarding of incoming and outgoing data between your LAN and the Internet. This chapter explains how to create IP filter rules.

Overview

The IP filter feature enables you to control the types of data being passed between the Internet and your network. You can create IP filter rules to block attempts by certain computers on your LAN to access certain types of data or Internet locations. You can also block incoming access to computers on your LAN.

When you define an IP filter rule and enable the feature, you instruct the ATU-R110 to examine each data packet it receives to determine whether it meets criteria set forth in the rule. The criteria can include the size of the packet, the network or internet protocol it is carrying, the direction in which it is traveling (for example, from the LAN to the Internet or vice versa), the IP address of the sending computer, the destination IP address, and other characteristics of the packet data.

If the packet matches the criteria established in a rule, the packet can be either accepted (forwarded towards its destination), or denied (discarded), depending on the action specified in the rule.

Viewing Your IP Filter Configuration

To view your current IP filter configuration, log into Configuration Manager, click the Services tab, and then click **IP Filter** in the task bar. The IP Filter page displays, as shown in Figure 46.

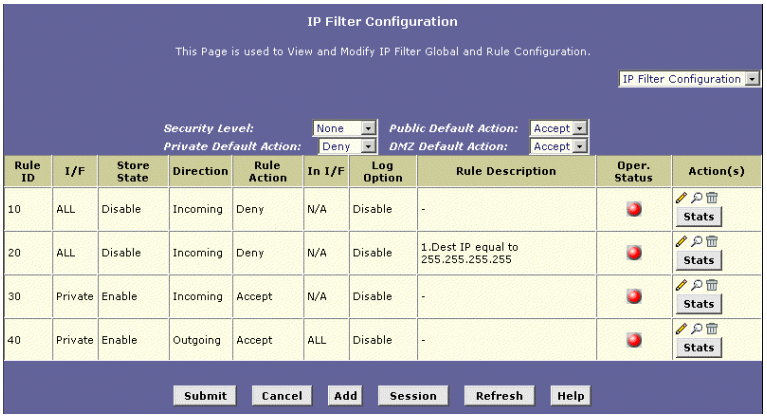

IP Filter Configuration
This Page is used to View and Modify IP Filter Global and Rule Configuration.
IP Filter Configuration
Security Level: None
Public Default Action: Accept
Private Default Action: Deny
DMZ Default Action: Accept
Rule ID | I/F | Store State | Direction | Rule Action | In I/F | Log Option | Rule Description | Oper. Status | Action(s)
10 | ALL | Disable | Incoming | Deny | N/A | Disable | - | Stats
20 | ALL | Disable | Incoming | Deny | N/A | Disable | 1.Dest IP equal to 255.255.255.255 | Stats
30 | Private | Enable | Incoming | Accept | N/A | Disable | - | Stats
40 | Private | Enable | Outgoing | Accept | ALL | Disable | - | Stats
Submit
Cancel
Add
Session
Refresh
Help

Figure 46. IP Filter Page

The IP Filter Configuration page displays global settings that you can modify, and the IP Filter rule table, which shows all currently established rules. See ¡ Creating IP Filter Rules¡¨ on page114 for a description of the items that make up a rule. When rules are defined, you can use the icons that display in the Actions column to edit (), delete (), and view details on () the corresponding rule.

Configuring IP Filter Global Settings

The IP Filter Configuration page enables you to configure several global IP Filter settings, and displays a table showing all existing IP Filter rules. The global settings that you can configure are:

- **Security Level:** This setting determines which IP Filter rules take effect, based on the security level specified in each rule. For example, when *High* is selected, only those rules that are assigned a security value of *High* will be in effect. The same is true for the *Medium* and *Low* settings. When *None* is selected, IP Filtering is disabled.
- **Private/Public/DMZ Default Action:** This setting specifies a default action to be taken (Accept or Deny) on private, public, or DMZ-type device interfaces when they receive packets that *do not* match any of the filtering rules. You can specify a different default action for each interface type. (You specify an interface's type when you create the interface; see the PPP configuration page, for example.)

  A *public* interface typically connects to the Internet. PPP, EoA, and IPoA interfaces are typically public. Packets received on a public interface are subject to the most restrictive set of firewall protections defined in the software. Typically, the global setting for public interfaces is *Deny*, so that all accesses to your LAN initiated from external computers are denied (discarded at the public interface), except for those allowed by a specific IP Filter rule.

  A *private* interface connects to your LAN, such as the Ethernet interface. Packets received on a private interface are subject to a less restrictive set of protections, because they originate within the network. Typically, the global setting for private interfaces is *Accept*, so that LAN computers have access to the ADSL/Ethernet routers' Internet connection.

  The term *DMZ* (de-militarized zone), in Internet networking terms, refers to computers that are available for both public and in-network accesses (such as a company's public Web server). Packets received on a DMZ interface¡ a whether from a LAN or external source¡ are subject to a set of protections that is in between public and private interfaces in terms of restrictiveness. The global setting for DMZ-type interfaces may be set to *Deny* so that all attempts to access these servers are denied by default; the administrator may then configure IP Filter rules to allow accesses of certain types.

Creating IP Filter Rules

To create an IP filter rule, you set various criteria that must be met in order for the rule to be invoked. Use these instructions to add a new IP filter rule, and refer to the examples on page 119 for assistance:

1. On the main IP Filter page, click **Add**.

   The IP Filter Rule – Add page displays, as shown in Figure 47.

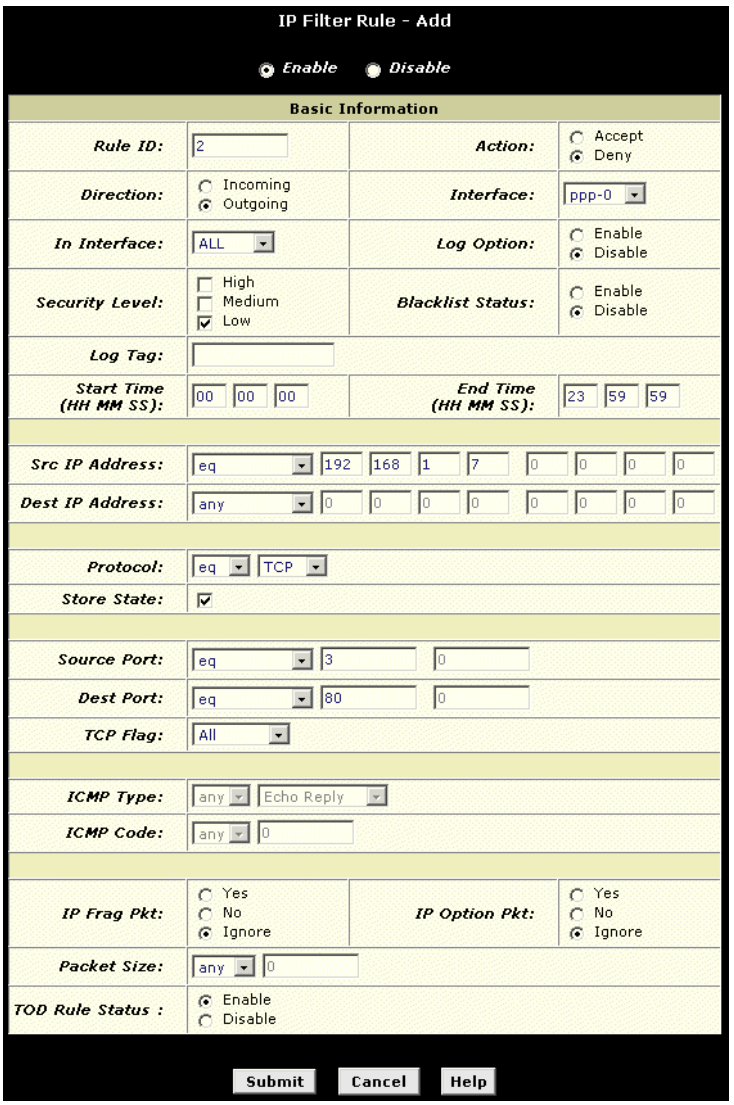


Figure 47. IP Filter Rule – Add Page

2. Enter or select data for each field that applies to your rule. The following table describes the fields:

Field	Description
Rule ID	Each rule must be assigned a sequential ID number. Rules are processed from lowest to highest on each data packet, until a match is found. It is recommended that you assign rule IDs in multiples of 5 or 10 (e.g., *10*, *20*, *30*) so that you leave enough room between them for inserting a new rule if necessary.
Action	The action that will be taken when a packet matches the rule criteria. The action can be *Accept* (forward to destination) or *Deny* (discard the packet).
Direction	Specifies whether the rule should apply to data packets that are incoming or outgoing on the selected interface. *Incoming* refers to packets coming from the LAN, and *outgoing* refers to packets going to the Internet. You can use rules that specify the incoming direction to restrict external computers from accessing your LAN.
Interface	The interface on the ATU-R110 on which the rule will take effect. See the examples on page 119 for suggestions on choosing the appropriate interface for various rule types.
In Interface	The interface from which packets must have been forwarded to the interface specified in the previous selection. This option is valid only for the outgoing direction.
Log Option	When *Enabled* is selected, a log entry will be created on the system each time this rule is invoked. The log entry will include the time of the violation, the source address of the computer responsible for the violation, the destination IP address, the protocol being used, the source and destination ports, and the number violations occurring in the previous x minutes. (Logging may be helpful when troubleshooting.) This information can also be e-mailed to designated administrators. See Chapter 1, ¡Introduction¡¨ for instructions.
Security Level	The security level that must be enabled globally for this rule to take affect. A rule will be active only if its security level is the same as the globally configured setting (shown on the main IP Filter page). For example, if the rule is set to Medium and the global firewall level is set to Medium, then the rule will be active; but if the global firewall level is set to High or Low, then the rule will be inactive.

Field	Description
Black List Status	Specifies whether or not a violation of this rule will result in the offending computer's IP address being added to the Black List, which blocks the ADSL/Ethernet router from forwarding packets from that source for a specified period of time. See Chapter 1, "Introduction¡¨ for instructions
Log Tag	A description of up to 16 characters to be recorded in the log in the event that a packet violates this rule. Be sure to set the Log Option to *Enable* if you configure a Log Tag.
Start/End Time	The time range during which this rule is to be in effect, specified in military units.
Src IP Address	IP address criteria for the source computer(s) from which the packet originates. In the drop-down list, you can configure the rule to be invoked on packets containing: **any**: any source IP address. **lt**: *any* source IP address that is numerically *less than* the specified address. **lteq**: any source IP address that is numerically *less than or equal to* the specified address. **gt**: any source IP address that is numerically *greater than* the specified address. **eq**: any source IP address that is numerically *equal to* the specified address. **neq**: any source IP address that is *not equal to* the specified address. **range**: any source IP address that is within the specified range, inclusive. **out of range**: any source IP address that is outside the specified range. **self**: the IP address of the ADSL/Ethernet router interface on which this rule takes effect.
Dest IP Address	IP address rule criteria for the destination computer(s) (i.e., the IP address of the computer to which the packet is being sent). In addition to the options described for the Src IP Address field, the following option is available: **bcast**: Specifies that the rule will be invoked for any packets sent to the broadcast address for the receiving interface. (The broadcast address is used to send packets to all hosts on the LAN or subnet connected to the specified interface.) When you select this option, you do not need to specify the address, so the address fields are dimmed.

Field	Description
Protocol	The basic IP protocol criteria that must be met for rule to be invoked. Using the options in the drop-down list, you can specify that packets must contain the selected protocol (*eq*), that they must not contain the specified protocol (*neq*), or that the rule can be invoked regardless of the protocol (*any*). TCP, UDP, and ICMP are commonly IP protocols; others can be identified by number from 0-255, as defined by the Internet Assigned Numbers Authority (IANA).
Store State	If this option is enabled, then *stateful filtering* is performed and the rule is also applied in the other direction on the given interface during an IP session.
Source Port	Port number criteria for the computer(s) from which the packet originates. This field will be dimmed (unavailable for entry) if you have not specified a protocol criteria. See the description of Src IP Address for the selection options.
Dest Port	Port number criteria for the destination computer(s) (i.e., the port number of the type of computer to which the packet is being sent). This field will be dimmed (unavailable for entry) unless you have selected TCP or UDP as the protocol. See the description of Src IP Address for the selection options.
TCP Flag	Specifies whether the rule should apply only to TCP packets that contain the synchronous (*SYN*) flag, only to those that contain the non-synchronous (*NOT-SYN*) flag, or to all TCP packets. This field will be dimmed (unavailable for entry) unless you selected TCP as the protocol.
ICMP Type	Specifies whether the value in the type field in ICMP packet headers will be used as a criteria. The code value can be any decimal value from 0-255. You can specify that the value must equal (*eq*) or not equal (*neq*) the specified value, or you can select *any* to enable the rule to be invoked on all ICMP packets. This field will be dimmed (unavailable for entry) unless you specify ICMP as the protocol.

Field	Description
ICMP Code	Specifies whether the value in the code field in ICMP packet headers will be used as a criteria. The code value can be any decimal value from 0-255. You can specify that the value must equal (*eq*) or not equal (*neq*) the specified value, or you can select *any* to enable the rule to be invoked on all ICMP packets. This field will be dimmed (unavailable for entry) unless you specify ICMP as the protocol.
IP Frag Pkt	Determines how the rule applies to IP packets that contain fragments. You can choose from the following options: O **Yes**: The rule will be applied only to packets that contain fragments. o **No**: The rule will be applied only to packets that do not contain fragments. o **Ignore**: (Default) The rule will be applied to packets whether or not they contain fragments, assuming that they match the other criteria.
IP Option Pkt	Determines whether the rule should apply to IP packets that have options specified in their packet headers. O **Yes:** The rule will be applied only to packets that contain header options. o **No:** The rule will be applied only to packets that do not contain header options. o **Ignore:** (Default) The rule will be applied to packets whether or not they contain header options, assuming that they match the other criteria.
Packet Size	Specifies that the IP Filter rule will take affect only on packets whose size in bytes matches this criteria. (*lt* = less than, *gt* = greater than, *lteq* = less than or equal to, etc.)
TOD Rule Status	The Time of Day Rule Status determines how the Start Time/End Time settings are used. o **Enable:** (Default) The rule is in effect for the specified time period. o **Disable:** The rule is not in effect for the specified time period, but is effective at all other times.

3. When you are done selecting criteria, ensure that the Enable radio button is selected at the top of the page, and then click Submit.

   After a confirmation page displays, the IP Filter Configuration page will redisplay with the new rule showing in the table.

   If the security level of the rule matches the globally configured setting, a green ball in the Status column for that rule, indicating that the rule is now in effect. A red ball will display when the rule is disabled or if its security level is different than the globally configured level.

4. Ensure that the Security Level and Private/Public/DMZ Default Action settings on the IP Filter Configuration page are configured as needed, then click Submit

   A page displays to confirm your changes.

5. Click the Admin tab, and then click **Commit & Reboot** in the task bar.

6. Click Commit to save your changes to permanent memory.

IP filter rule examples

Example 1. Blocking a specific computer on your LAN from using accessing web servers on the Internet:

1. Add a new rule for outgoing packets on the ppp-0 interface from any incoming interface (this would include the eth-0 and usb-0 interfaces, for example).
2. Specify a source IP address of the computer you want to block.
3. Specify the Protocol = *TCP* and enable the Store State setting.
4. Specify a destination port = *80*, which is the well-known port number for web servers.
5. Enable the rule by clicking the radio button at the top of the page.
6. Click Submit to create the rule.
7. On the IP Filter Configuration page, set the Security Level to the same level you chose for the rule, and set both the Private Default Action and the Public Default Action to *Accept*.
8. Click Submit, and commit your changes.

Figure 47 on page 114 shows the configuration for this rule. The specified computer will not be able to access the Web, but will be

able to access FTP Internet sites (and any others that use destination port numbers other than 80).

Example 2. Blocking Telnet accesses to the ATU-R110 :

1. Add a new rule for packets incoming on the ppp-0 interface.
2. Specify that the packet must contain the TCP protocol, and must be destined for port 23, the well-known port number used for the Telnet protocol.
3. Enable the rule by clicking the radio button at the top of the page.
4. Click Submit to create the rule, and commit your changes.

Figure 48 shows how this rule could be configured:

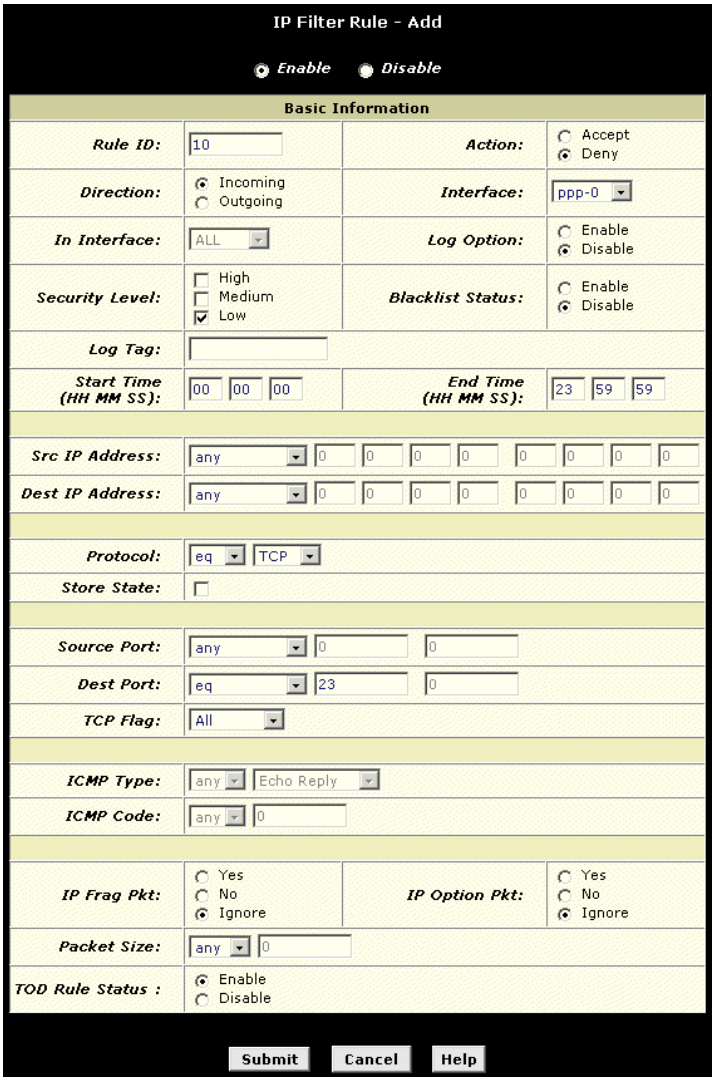


Figure 48. IP Filter Rule Example 2

Viewing IP Filter Statistics

For each rule, you can view statistics on how many packets were accepted or denied. Display the IP Filter Configuration page, and then click Stats in the row corresponding to the rule. The IP Filter Rule ¡ Statistics page displays, as shown in Figure 49.

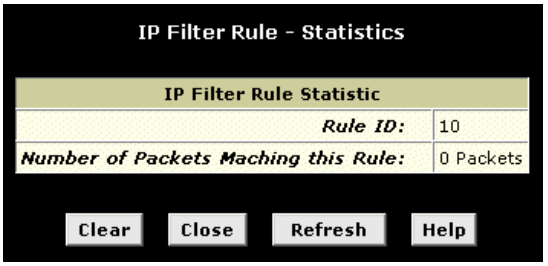


Figure 49. IP Filter Rule ¡ Statistics Page

You can click Clear to reset the count to zero and Refresh to display newly accumulated data.

Managing Current IP Filter Sessions

When two computers communicate using the IP protocol, an IP session is created for the duration of the communication. The ATU-R110allows a fixed number of concurrent IP sessions. You can view information about each current IP session and delete sessions (for security reasons, for example).

To view all current IP sessions, display the IP Filters Configuration page, and then click Session. Figure 121 shows an example of an IP Filter Sessions page.

IP Filter Session

Session Index	Time to expire	Protocol	I/F	IP Address	Port	In Rule Index	In Action	Out Rule Index	Out Action	Action (s)
1	252	UDP	eth-0 Self	10.0.20.70 255.255.255.255	9830 69	30 0	Accept Unknown	30 0	Accept Unknown	
2	60	TCP	eth-0 Self	192.168.51.138 192.168.51.239	1721 80	30 0	Accept Unknown	30 0	Accept Unknown	
4	132	UDP	eth-0 Self	192.168.51.120 192.168.51.255	138 138	30 0	Accept Unknown	30 0	Accept Unknown	
8	12	UDP	eth-0 Self	192.168.51.162 192.168.51.255	138 138	0 0	Unknown Unknown	0 0	Unknown Unknown	
13	122	UDP	eth-0 Self	192.168.51.115 192.168.51.255	138 138	30 0	Accept Unknown	30 0	Accept Unknown	

Figure 50. IP Filter Sessions Page

The IP Filter Session table displays the following fields for each current IP session:

Field	Description
Session Index	The ID assigned by the system to the IP session (all sessions, whether or not they are affected by an IP filter rule, are assigned a session index).
Time to expire	The number of seconds in which the connection will automatically expire
Protocol	The underlying IP protocol used on the connection, such as TCP, UDP, IGMP, etc.)
I/F	The interface on which the IP Filter rule is effective
IP Address	The IP addresses involved in the communication. The first one shown is the initiator of the communication.
Port	The hardware addresses of the ports involved in the communication
In/Out Rule Index	The number of the IP Filter rule that is applies to this session (assigned when the rule was created)
In/Out Action	The action (accept, deny, or unknown), being taken on data coming into or going out on the interface. This action is specified in the rule definition.
Actions	Provides a icon you can click on ( ) to delete the IP session. When you delete a session, the communication between is discontinued.

You can click

to display newly accumulated data.

19 Viewing DSL Parameters

To view configuration parameters and performance statistics for the ATU-R110¡¦s DSLli nelog into Configuration Manager, and then click the WAN tab. The DSL Status page displays by default, as shown in Figure 51.

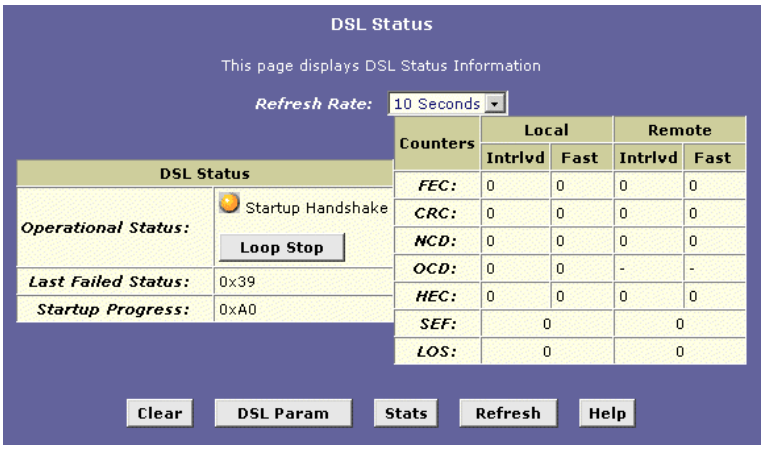


Figure 51. DSL Status Page

The DSL Status page displays current information on the DSL line performance. The page refreshes according to the setting in the Refresh drop-down list, which you can configure. You can click Clear to reset all counters to zero, and Refresh to redisplay the page with newly accumulated values.

Although you generally will not need to view this data, it may be helpful when troubleshooting connection or performance problems with your ISP.

You can click DSL Param to display data about the configuration of the DSL line, as shown in Figure 52.

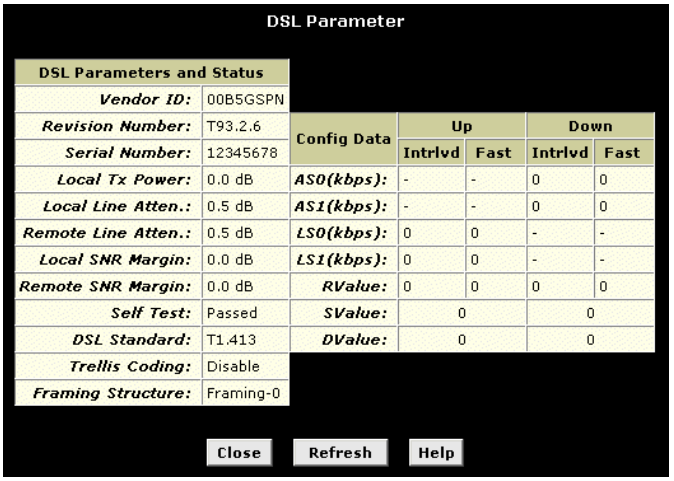


Figure 52. DSL Parameters Page

- The DSL Parameters and Status table displays settings preconfigured by the product manufacturer or your ISP.
- The Config Data table lists various types of error and defects measurements found on the DSL line.

You cannot modify this data.

From the DSL Status page, you can click **Stats** to display DSL line performance statistics, as shown in Figure 53.

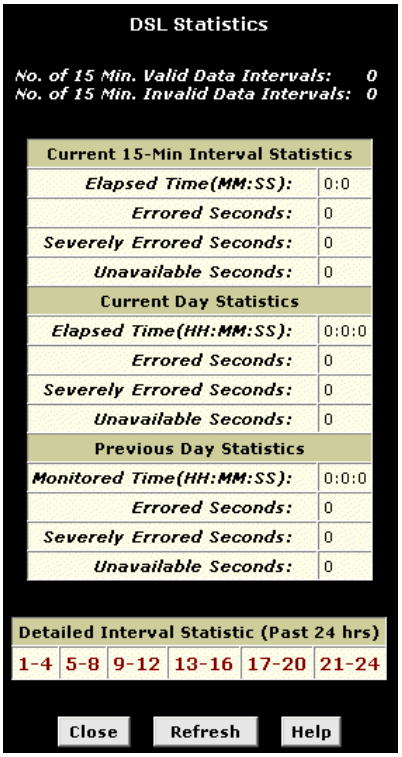
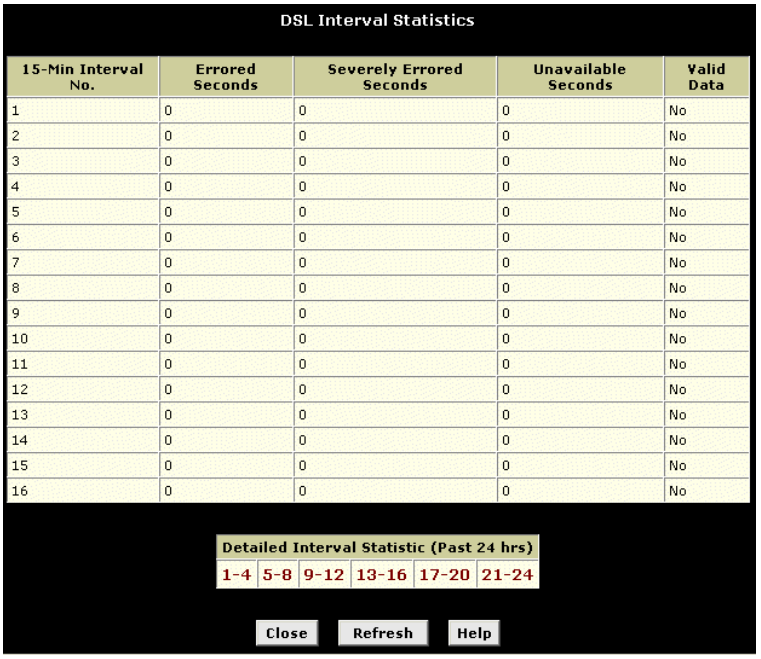


Figure 53. DSL Statistics Page

The DSL Statistics page reports error data relating to the last 15 minute interval, the current day, and the previous day.

At the bottom of the page, the Detailed Interval Statistic table displays links you can click on to display detailed data for each 15 minute interval in the past 24 hours. For example, when you click on 1-4, data displays for the 16 intervals (15-minutes each) that make up the previous 4 hours. Figure 54 shows an example.



DSL Interval Statistics

15-Min Interval No.	Errored Seconds	Severely Errored Seconds	Unavailable Seconds	Valid Data
1	0	0	0	No
2	0	0	0	No
3	0	0	0	No
4	0	0	0	No
5	0	0	0	No
6	0	0	0	No
7	0	0	0	No
8	0	0	0	No
9	0	0	0	No
10	0	0	0	No
11	0	0	0	No
12	0	0	0	No
13	0	0	0	No
14	0	0	0	No
15	0	0	0	No
16	0	0	0	No

Detailed Interval Statistic (Past 24 hrs)

1-4 | 5-8 | 9-12 | 13-16 | 17-20 | 21-24

Close Refresh Help

Figure 54. DSL Interval Statistics Page

20 Viewing System Alarms

You can use the Configuration Manager to view information about alarms that occur in the system. Alarms, also called traps, are caused by a variety of system events, including connection attempts, resets, and configuration changes.

Although you will not typically need to view this information, it may be helpful in working with your ISP to troubleshoot problems you encounter with the device. (Despite their name, not all alarms indicate problems in the functioning of the system.)

Viewing the Alarm Table

To display the Alarm page, log into the Configuration Manager, click the Admin tab, and then click **Alarm** in the task bar.

The Alarm page displays, as shown in Figure 55.

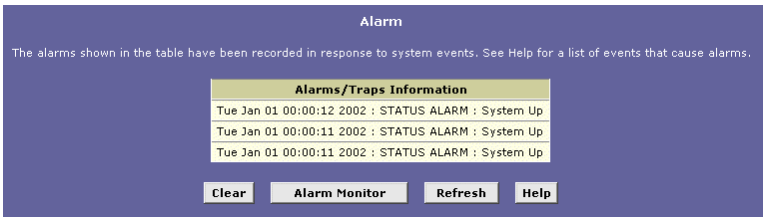

Alarm
The alarms shown in the table have been recorded in response to system events. See Help for a list of events that cause alarms.
Alarms/Traps Information
Tue Jan 01 00:00:12 2002 : STATUS ALARM : System Up
Tue Jan 01 00:00:11 2002 : STATUS ALARM : System Up
Tue Jan 01 00:00:11 2002 : STATUS ALARM : System Up
Clear
Alarm Monitor
Refresh
Help

Figure 55. Alarm Page

Each row in the table displays the time and date that an alarm occurred, the type of alarm, and a brief statement indicating its cause.

To remove all entries from the list, click Clear. New entries will begin accumulating and will display when you click Refresh.

Displaying the Alarm Monitor in a Separate Window

If you want to display an automatically updating Alarm table, you can click Alarm Monitor to display a separate Alarm Monitor window, as shown in Figure 56.

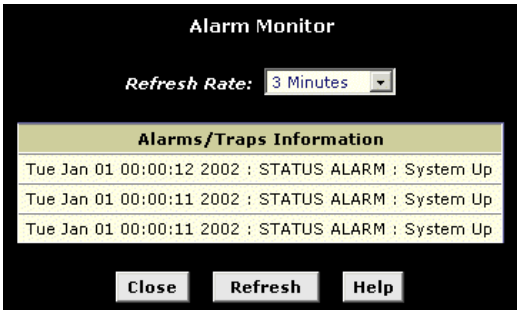

Alarm Monitor
Refresh Rate:
3 Minutes
Alarms/Traps Information
Tue Jan 01 00:00:12 2002 : STATUS ALARM : System Up
Tue Jan 01 00:00:11 2002 : STATUS ALARM : System Up
Tue Jan 01 00:00:11 2002 : STATUS ALARM : System Up
Close
Refresh
Help

Figure 56. Alarm Monitor Window

You can click on the Refresh Rate drop-down list to select a recurring time interval after which the page will redisplay with new data.

You can leave the Alarm Monitor window open and active even after closing the Configuration Manager.

A IP Addresses, Network Masks, and Subnets

IP Addresses

Note

This section pertains only to IP addresses for IPv4 (version 4 of the Internet Protocol). IPv6 addresses are not covered.

This section assumes basic knowledge of binary numbers, bits and bytes. For details on this subject, see Appendix 0.

IP addresses, the Internet's version of telephone numbers, are used to identify individual nodes (computers or devices) on the Internet. Every IP address contains four numbers, each from 0 to 255 and separated by dots (periods), e.g. 20.56.0.211. These numbers are called, from left to right, field1, field2, field3, and field4.

This style of writing IP addresses as decimal numbers separated by dots is called *dotted decimal notation*. The IP address 20.56.0.211 is read "twenty dot fifty-six dot zero dot two-eleven."

Structure of an IP address

IP addresses have a hierarchical design similar to that of telephone numbers. For example, a 7-digit telephone number starts with a 3-digit prefix that identifies a group of thousands of telephone lines, and ends with four digits that identify one specific line in that group.

Similarly, IP addresses contain two kinds of information.

- *Network ID*
  Identifies a particular network within the Internet or intranet
- *Host ID*
  Identifies a particular computer or device on the network

The first part of every IP address contains the network ID, and the rest of the address contains the host ID. The length of the network ID depends on the network's *class* (see following section). Table 3 shows the structure of an IP address.

Table 3. IP Address structure

	Field1	Field2	Field3	Field4
Class A	Network ID	Host ID		
Class B	Network ID		Host ID	
Class C	Network ID			Host ID

Here are some examples of valid IP addresses:

Class A: 10.30.6.125 (network = 10, host = 30.6.125)
Class B: 129.88.16.49 (network = 129.88, host = 16.49)
Class C: 192.60.201.11 (network = 192.60.201, host = 11)

Network classes

The three commonly used network classes are A, B, and C. (There is also a class D but it has a special use beyond the scope of this discussion.) These classes have different uses and characteristics.

Class A networks are the Internet's largest networks, each with room for over 16 million hosts. Up to 126 of these huge networks can exist, for a total of over 2 billion hosts. Because of their huge size, these networks are used for WANs and by organizations at the infrastructure level of the Internet, such as your ISP.

Class B networks are smaller but still quite large, each able to hold over 65,000 hosts. There can be up to 16,384 class B networks in existence. A class B network might be appropriate for a large organization such as a business or government agency.

Class C networks are the smallest, only able to hold 254 hosts at most, but the total possible number of class C networks exceeds 2 million (2,097,152 to be exact). LANs connected to the Internet are usually class C networks.

Some important notes regarding IP addresses:

- The class can be determined easily from field1:
  field1 = 1-126: Class A
  field1 = 128-191: Class B
  field1 = 192-223: Class C
  (field1 values not shown are reserved for special uses)
- A host ID can have any value except all fields set to 0 or all fields set to 255, as those values are reserved for special uses.

Subnet masks

Definition
mask

A mask *looks like a regular IP address, but contains a pattern of bits that tells what parts of an IP address are the network ID and what parts are the host ID: bits set to 1 mean "this bit is part of the network ID" and bits set to 0 mean "this bit is part of the host ID."*

Subnet masks are used to define *subnets* (what you get after dividing a network into smaller pieces). A subnet's network ID is created by "borrowing" one or more bits from the host ID portion of the address. The subnet mask identifies these host ID bits.

For example, consider a class C network 192.168.1. To split this into two subnets, you would use the subnet mask:

255.255.255.128

It's easier to see what's happening if we write this in binary:

11111111. 11111111. 11111111.10000000

As with any class C address, all of the bits in field1 through field 3 are part of the network ID, but note how the mask specifies that the first bit in field 4 is also included. Since this extra bit has only two values (0 and 1), this means there are two subnets. Each subnet

uses the remaining 7 bits in field4 for its host IDs, which range from 0 to 127 (instead of the usual 0 to 255 for a class C address).

Similarly, to split a class C network into four subnets, the mask is:

255.255.255.192 or 11111111. 11111111. 11111111.11000000

The two extra bits in field4 can have four values (00, 01, 10, 11), so there are four subnets. Each subnet uses the remaining six bits in field4 for its host IDs, ranging from 0 to 63.

Note

Sometimes a subnet mask does not specify any additional network ID bits, and thus no subnets. Such a mask is called a default subnet mask*. These masks are:*

Class A: 255.0.0.0
Class B: 255.255.0.0
Class C: 255.255.255.0

These are called default *because they are used when a network is initially configured, at which time it has no subnets.*

B Binary Numbers

Binary Numbers

In everyday life, we use the decimal system of numbers. In decimal, numbers are written using the ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Computers, however, do not use decimal. Instead, they use *binary*.

Definition
binary numbers

Hint

Just as each digit in a decimal number represents a multiple of 10 (1, 10, 100, 1000, 10,000, etc.), each digit in a binary number represents a multiple of 2 (1, 2, 4, 8, 16, etc.). For example:

Decimal					Binary			
1,000's	100's	10's	1's		8's	4's	2's	1's
-	-	**1**	**3**	**=**	**1**	**1**	**0**	**1**

Also, since binary uses only two digits to represent all numbers, a binary number has more digits than the same number in decimal. In the example above, you can see that the decimal number 13 is the same as the binary number 1101 (8 + 4 + 1 = 13).

Bits and bytes

Computers handle binary numbers by grouping them into units of distinct sizes. The smallest unit is called a *bit*, and the most commonly used unit is called a *byte*.

Definition
bit and byte

A bit *is a single binary digit, i.e., 0 or 1.*

A byte *is a group of eight consecutive bits (the number of bits can vary with computers, but is almost always eight), e.g., 11011001. The value of a byte ranges from 0 (00000000) to 255 (11111111).*

The following shows the values of the eight digits in a byte along with a sample value:

128's	64's	32's	16's	8's	4's	2's	1's
1	**0**	**1**	**0**	**1**	**1**	**0**	**1**

The decimal value of this byte is 173 (128 + 32 + 8 + 4 + 1 = 173).

C Troubleshooting

This appendix suggests solutions for problems you may encounter in installing or using the ATU-R110, and provides instructions for using several IP utilities to diagnose problems.

Contact Customer Support if these suggestions do not resolve the problem.

Problem	Troubleshooting Suggestion
LEDs	
Power LED does not illuminate after product is turned on.	Verify that you are using the power cable provided with the device and that it is securely connected to the ATU-R110 and a wall socket/power strip.
LINK WAN LED does not illuminate after phone cable is attached.	Verify that a standard telephone cable like the one provided is securely connected to the ADSL port and your wall phone jack. Wait 30 seconds to allow the device to negotiate a connection with your ISP.
LINK LAN LED does not illuminate after Ethernet cable is attached.	Verify that the Ethernet cable is securely connected to your LAN hub or PC and to the ATU-R110. Make sure the PC and/or hub is turned on. Verify that you are using a straight-through type Ethernet cable to the uplink port on a hub or a cross-over type cable to a stand-alone PC. If you connected the device to an ordinary hub port (not Uplink), you must use a straight-through cable. (Hold the connectors at each end of the cable side-by-side in the same position. If the order of their color-coded wire pairs is the same, it is a straight-through type.) Contact Customer Support if your cable is not the correct type. Verify that your cable is sufficient for your network requirements. A 100 Mbit/sec network (10BaseTx) should use cables labeled Cat 5. 10Mbit/sec cables may tolerate lower quality cables.
DIAG LED stays illuminated after turning the device on.	The DIAG LED should turn off after about 10-15 seconds. If it does not, turn off the ATU-R110, wait 10 seconds, and then turn it back on.
Internet Access	
PC cannot access Internet	Use the ping utility, discussed in the following section, to check whether your PC can communicate with the ATU-R110¡¦s LAN IP address (by default 192.168.1.1). If it cannot, check the Ethernet cabling. If you statically assigned a private IP address to the computer, (not a registered public address), verify the following: Check that the gateway IP address on the computer is your public IP address (see the Quick Start chapter, Part 2 for instructions on viewing the IP information.) If it is not, correct the address or configure the PC to receive IP information automatically. Verify with your ISP that the DNS server specified for the PC is valid. Correct the address or configure the PC to receive this information automatically. Verify that a Network Address Translation rule has been defined on the ATU-R110 to translate the private address to your public IP address.

Problem	Troubleshooting Suggestion
	The assigned IP address must be within the range specified in the NAT rules (see Chapter 8). Or, configure the PC to accept an address assigned by another device (see the Quick Start, Part 2). The default configuration includes a NAT rule for all dynamically assigned addresses within a predefined pool (see the instructions in Chapter 7 to view the address pool).
PCs cannot display web pages on the Internet.	Verify that the DNS server specified on the PCs is correct for your ISP, as discussed in the item above. You can use the ping utility, discussed in the following section, to test connectivity with your ISP¡¦s DNS server
Configuration Manager Program	
You forgot/lost your Configuration Manager user ID or password.	If you have not changed the password from the default, try using ¡§root¡¨ as both the user ID and password. Otherwise, you can reset the device to the default configuration by pressing the Reset button on the back panel of the device (using a pointed object such as a pen tip). Then, type the default User ID and password shown above. **WARNING:** Resetting the device removes any custom settings and returns all settings to their default values.
Cannot access the Configuration Manager program from your browser.	Use the ping utility, discussed in the following section, to check whether your PC can communicate with the ATU-R110¡¦s LAN IP address (by default 192.168.1.1). If it cannot, check the Ethernet cabling. Verify that you are using Internet Explorer v5.0 or later, or Netscape Navigator v4.7 or later. Support for JavascriptR must be enabled in your browser. Support for JavaR may also be required. Verify that the PC¡¦s IP address is defined as being on the same subnet as the IP address assigned to the LAN port on the ATU-R110.
Changes to Configuration Manager are not being retained.	Be sure to use the Commit function after any changes. This function is described on page 32.

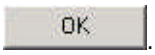
Diagnosing Problem using IP Utilities

ping

Ping is a command you can use to check whether your PC can recognize other computers on your network and the Internet. A ping command sends a message to the computer you specify. If the computer receives the message, it sends messages in reply. To use it, you must know the IP address of the computer you are trying to communicate with.

On Windows-based computers, you can execute a ping command from the Start menu. Click the Start button, and then click Run. In the Open text box, type a statement such as the following:

ping 192.168.1.1

Click 

. You can substitute any private IP address on your LAN or a public IP address for an Internet site, if known.

If the target computer receives the message, a Command Prompt window displays like that shown in Figure 57.

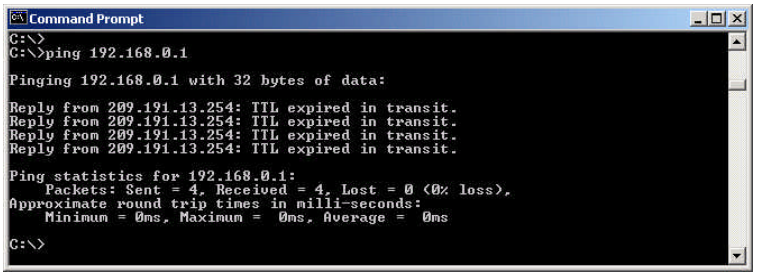

Command Prompt
C:\>
C:\>ping 192.168.0.1
Pinging 192.168.0.1 with 32 bytes of data:
Reply from 209.191.13.254: TTL expired in transit.
Reply from 209.191.13.254: TTL expired in transit.
Reply from 209.191.13.254: TTL expired in transit.
Reply from 209.191.13.254: TTL expired in transit.
Ping statistics for 192.168.0.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>

Figure 57. Using the ping Utility

If the target computer cannot be located, you will receive the message ¡§Request timed out.

Using the ping command, you can test whether the path to the ATU-R110 is working (using the preconfigured default LAN IP address 192.168.1.1) or another address you assigned.

You can also test whether access to the Internet is working by typing an external address, such as that for www.yahoo.com (216.115.108.243). If you do not know the IP address of a particular Internet location, you can use the nslookup command, as explained in the following section.

From most other IP-enabled operating systems, you can execute the same command at a command prompt or through a system administration utility.

nslookup

You can use the nslookup command to determine the IP address associated with an internet site name. You specify the common name, and the nslookup command looks up the name in on your DNS server (usually located with your ISP). If that name is not an entry in your ISP's DNS table, the request is then referred to another higher-level server, and so on, until the entry is found. The server then returns the associated IP address.

On Windows-based computers, you can execute the nslookup command from the Start menu. Click the Start button, and then click Run. In the Open text box, type the following:

nslookup

Click OK. A Command Prompt window displays with a bracket prompt (>). At the prompt, type the name of the internet address your are interested in, such as www.microsoft.com.

The window will display the associate IP address, if known, as shown in Figure 58.

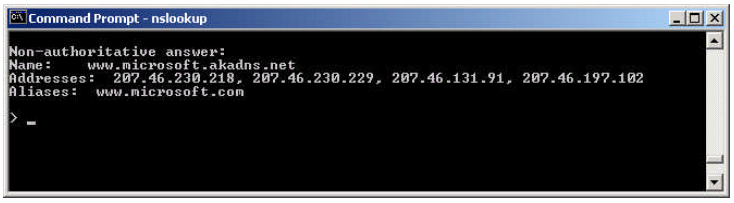


Figure 58. Using the nslookup Utility

There may be several addresses associated with an Internet name. This is common for web sites that receive heavy traffic; they use multiple, redundant servers to carry the same information.

To exit from the nslookup utility, type **exit** and press **<Enter>** at the command prompt.

D Glossary

10BASE-T — A designation for the type of wiring used by Ethernet networks with a data rate of 10 Mbps. Also known as Category 3 (CAT 3) wiring. *See also data rate, Ethernet*.

100BASE-T — A designation for the type of wiring used by Ethernet networks with a data rate of 100 Mbps. Also known as Category 5 (CAT 5) wiring. *See also data rate, Ethernet*.

ADSL — Asymmetric Digital Subscriber Line
The most commonly deployed "flavor" of DSL for home users. The term asymmetrical refers to its unequal data rates for downloading and uploading (the download rate is higher than the upload rate). The asymmetrical rates benefit home users because they typically download much more data from the Internet than they upload.

analog — Of data, having a form is analogous to the data's original waveform. The voice component in DSL is an analog signal. *See also digital*.

ATM — Asynchronous Transfer Mode
A standard for high-speed transmission of data, text, voice, and video, widely used within the Internet. ATM data rates range from 45 Mbps to 2.5 Gbps. *See also data rate*.

authenticate — To verify a user's identity, such as by prompting for a password

binary — The "base two" system of numbers, that uses only two digits, 0 and 1, to represent all numbers. In binary, the number 1 is written as 1, 2 as 10, 3 as 11, 4 as 100, etc. Although expressed as decimal numbers for convenience, IP addresses in actual use are binary numbers; e.g., the IP address 209.191.4.240 is 11010001.10111111.00000100.11110000 in binary. *See also bit, IP address, network mask*.

bit — Short for "binary digit," a bit is a number that can have two values, 0 or 1. *See also binary*.

bps — bits per second

bridging — Passing data from your network to your ISP and vice versa using the hardware addresses of the devices at each location. Bridging contrasts with routing, which can add more intelligence to data transfers by using network addresses instead. The ATU-R110 can perform both routing and bridging. Typically, when both functions are enabled, the device routes IP data and bridges all other types of data. See also *routing*.

broadband — A telecommunications technology that can send different types of data over the same medium. DSL is a broadband technology.

broadcast — To send data to all computers on a network.

DHCP — Dynamic Host Configuration Protocol
DHCP automates address assignment and management. When a computer connects to the LAN, DHCP assigns it an IP address

	from a shared pool of IP addresses; after a specified time limit, DHCP returns the address to the pool.
DHCP relay	Dynamic Host Configuration Protocol relay A DHCP relay is a computer that forwards DHCP data between computers that request IP addresses and the DHCP server that assigns the addresses. Each of the ATU-R110's interfaces can be configured as a DHCP relay. *See DHCP*.
DHCP server	Dynamic Host Configuration Protocol server A DHCP server is a computer that is responsible for assigning IP addresses to the computers on a LAN. *See DHCP*.
digital	Of data, having a form based on discrete values expressed as binary numbers (0's and 1's). The data component in DSL is a digital signal. *See also analog*.
DNS	Domain Name System The DNS maps domain names into IP addresses. DNS information is distributed hierarchically throughout the Internet among computers called DNS servers. When you start to access a web site, a DNS server looks up the requested domain name to find its corresponding IP address. If the DNS server cannot find the IP address, it communicates with higher-level DNS servers to determine the IP address. *See also domain name.*
domain name	A domain name is a user-friendly name used in place of its associated IP address. For example, www.globespan.net is the domain name associated with IP address 209.191.4.240. Domain names must be unique; their assignment is controlled by the Internet Corporation for Assigned Names and Numbers (ICANN). Domain names are a key element of URLs, which identify a specific file at a web site, e.g..
download	To transfer data in the downstream direction, i.e., from the Internet to the user.
DSL	Digital Subscriber Line A technology that allows both digital data and analog voice signals to travel over existing copper telephone lines.
Ethernet	The most commonly installed computer network technology, usually using twisted pair wiring. Ethernet data rates are 10 Mbps and 100 Mbps. *See also 10BASE-T, 100BASE-T, twisted pair*.
filtering	To screen out selected types of data, based on filtering rules. Filtering can be applied in one direction (upstream or downstream), or in both directions.
filtering rule	A rule that specifies what kinds of data the a routing device will accept and/or reject. Filtering rules are defined to operate on an interface (or multiple interfaces) and in a particular direction (upstream, downstream, or both).
firewall	Any method of protecting a computer or LAN connected to the Internet from intrusion or attack from the outside. Some firewall protection can be provided by packet filtering and Network Address Translation services.
FTP	File Transfer Protocol A program used to transfer files between computers connected

	to the Internet. Common uses include uploading new or updated files to a web server, and downloading files from a web server.
GGP	Gateway to Gateway Protocol. An Internet protocol that specifies how gateway routers communicate with each other.
Gbps	Abbreviation for Gigabits (¡§G-uh-bits¡¨) per second, or one billion bits per second. Internet data rates are often expressed in Gbps.
hop	When you send data through the Internet, it is sent first from your computer to a router, and then from one router to another until it finally reaches a router that is directly connected to the recipient. Each individual ¡§leg¡¨ of the data¡¦s journey is called a hop.
hop count	The number of hops that data has taken on its route to its destination. Alternatively, the maximum number of hops that a packet is allowed to take before being discarded (*see also TTL*).
host	A device (usually a computer) connected to a network.
HTTP	Hyper-Text Transfer Protocol HTTP is the main protocol used to transfer data from web sites so that it can be displayed by web browsers. *See also web browser, web site*.
ICMP	Internet Control Message Protocol An Internet protocol used to report errors and other network-related information. The ping command makes use of ICMP.
IGMP	Internet Group Management Protocol An Internet protocol that enables a computer to share information about its membership in multicast groups with adjacent routers. A multicast group of computers is one whose members have designated as interested in receiving specific content from the others. Multicasting to an IGMP group can be used to simultaneously update the address books of a group of mobile computer users or to send company newsletters to a distribution list.
in-line filter	*See microfilter*.
Internet	The global collection of interconnected networks used for both private and business communications.
intranet	A private, company-internal network that looks like part of the Internet (users access information using web browsers), but is accessible only by employees.
IP	*See TCP/IP*.
IP address	Internet Protocol address The address of a host (computer) on the Internet, consisting of four numbers, each from 0 to 255, separated by periods, e.g., 209.191.4.240. An IP address consists of a *network ID* that identifies the particular network the host belongs to, and a *host ID* uniquely identifying the host itself on that network. A network mask is used to define the network ID and the host ID. Because IP addresses are difficult to remember, they usually have an associated domain name that can be specified instead. *See also domain name, network mask*.

ISP	Internet Service Provider A company that provides Internet access to its customers, usually for a fee.
LAN	Local Area Network A network limited to a small geographic area, such as a home, office, or small building.
LED	Light Emitting Diode An electronic light-emitting device. The indicator lights on the front of the ATU-R110 are LEDs.
MAC address	Media Access Control address The permanent hardware address of a device, assigned by its manufacturer. MAC addresses are expressed as six pairs of characters.
mask	*See network mask*.
Mbps	Abbreviation for Megabits per second, or one million bits per second. Network data rates are often expressed in Mbps.
microfilter	In splitterless deployments, a microfilter is a device that removes the data frequencies in the DSL signal, so that telephone users do not experience interference (noise) from the data signals. Microfilter types include *in-line* (installs between phone and jack) and *wall-mount* (telephone jack with built-in microfilter). *See also splitterless*.
NAT	Network Address Translation A service performed by many routers that translates your network's publicly known IP address into a *private* IP address for each computer on your LAN. Only your router and your LAN know these addresses; the outside world sees only the public IP address when talking to a computer on your LAN.
NAT rule	A defined method for translating between public and private IP addresses on your LAN.
network	A group of computers that are connected together, allowing them to communicate with each other and share resources, such as software, files, etc. A network can be small, such as a *LAN*, or very large, such as the *Internet*.
network mask	A network mask is a sequence of bits applied to an IP address to select the network ID while ignoring the host ID. Bits set to 1 mean "select this bit" while bits set to 0 mean "ignore this bit." For example, if the network mask 255.255.255.0 is applied to the IP address 100.10.50.1, the network ID is 100.10.50, and the host ID is 1. *See also binary, IP address, subnet, "IP Addresses Explained" section*.
NIC	Network Interface Card An adapter card that plugs into your computer and provides the physical interface to your network cabling, which for Ethernet NICs is typically an RJ-45 connector. *See Ethernet, RJ-45*.
packet	Data transmitted on a network consists of units called packets. Each packet contains a payload (the data), plus overhead information such as where it came from (source address) and where it should go (destination address).

ping	Packet Internet (or Inter-Network) Groper A program used to verify whether or not the host associated with an IP address is online. It can also be used to reveal the IP address for a given domain name.
port	A physical access point to a device such as a computer or router, through which data flows into and out of the device.
POTS	Plain Old Telephone Service Traditional analog telephone service using copper telephone lines. Pronounced "pots." *See also PSTN*.
POTS splitter	*See splitter*.
PPP	Point-to-Point Protocol A protocol for serial data transmission that is used to carry IP (and other protocol) data between your ISP and your computer. The WAN interface on the ATU-R110 uses two forms of PPP called PPPoA and PPPoE. *See also PPPoA, PPPoE*.
PPPoA	Point-to-Point Protocol over ATM One of the two types of PPP interfaces you can define for a Virtual Circuit (VC), the other type being PPPoE. You can define only one PPPoA interface per VC.
PPPoE	Point-to-Point Protocol over Ethernet One of the two types of PPP interfaces you can define for a Virtual Circuit (VC), the other type being PPPoA. You can define one or more PPPoE interfaces per VC.
protocol	A set of rules governing the transmission of data. In order for a data transmission to work, both ends of the connection have to follow the rules of the protocol.
remote	In a physically separate location. For example, an employee away on travel who logs in to the company¡¦s intranet is a remote user.
RIP	Routing Information Protocol The original TCP/IP routing protocol. There are two versions of RIP, version I and version II.
RJ-11	Registered Jack Standard-11 The standard plug used to connect telephones, fax machines, modems, etc. to a telephone jack. It is a 6-pin connector usually containing four wires.
RJ-45	Registered Jack Standard-45 The 8-pin plug used in transmitting data over phone lines. Ethernet cabling usually uses this type of connector.
routing	Forwarding data between your network and the Internet on the most efficient route, based on the data¡¦s destination IP address and current network conditions. A device that performs routing is called a router.
rule	*See filtering rule, NAT rule*.
SDNS	Secondary Domain Name System (server) A DNS server that can be used if the primary DSN server is not available. *See DNS*.

SNMP	Simple Network Management Protocol The TCP/IP protocol used for network management.
splitter	A device that splits off the voice component of the DSL signal to a separate line, so that data and telephone service each have their own wiring and jacks. The splitter is installed by your telephone company where the DSL line enters your home. The CO also contains splitters that separate the voice and data signals, sending voice to the PSTN and data on high-speed lines to the Internet. *See also CO, PSTN, splitterless, microfilter*.
splitterless	A type of DSL installation where no splitter is installed, saving the cost of a service call by the telephone company. Instead, each jack in the home carries both voice and data, requiring a microfilter for each telephone to prevent interference from the data signal. ADSL is usually splitterless; if you are unsure if your installation has a splitter, ask your DSL provider. *See also splitter, microfilter*.
subnet	A subnet is a portion of a network. The subnet is distinguished from the larger network by a *subnet mask* which selects some of the computers of the network and excludes all others. The subnet's computers remain physically connected to the rest of the parent network, but they are treated as though they were on a separate network. *See also network mask*.
subnet mask	A mask that defines a subnet. *See also network mask*.
TCP	*See TCP/IP*.
TCP/IP	Transmission Control Protocol/Internet Protocol The basic protocols used on the Internet. TCP is responsible for dividing data up into packets for delivery and reassembling them at the destination, while IP is responsible for delivering the packets from source to destination. When TCP and IP are bundled with higher-level applications such as HTTP, FTP, Telnet, etc., TCP/IP refers to this whole suite of protocols.
Telnet	An interactive, character-based program used to access a remote computer. While HTTP (the web protocol) and FTP only allow you to download files from a remote computer, Telnet allows you to log into and use a computer from a remote location.
TFTP	Trivial File Transfer Protocol A protocol for file transfers, TFTP is easier to use than File Transfer Protocol (FTP) but not as capable or secure.
TTL	Time To Live A field in an IP packet that limits the life span of that packet. Originally meant as a time duration, the TTL is usually represented instead as a maximum hop count; each router that receives a packet decrements this field by one. When the TTL reaches zero, the packet is discarded.
twisted pair	The ordinary copper telephone wiring long used by telephone companies. It contains one or more wire pairs twisted together to reduce inductance and noise. Each telephone line uses one pair. In homes, it is most often installed with two pairs. For Ethernet LANs, a higher grade called Category 3 (CAT 3) is used for 10BASE-T networks, and an even higher grade called Category

	5 (CAT 5) is used for 100BASE-T networks. *See also 10BASE-T, 100BASE-T, Ethernet*.
upstream	The direction of data transmission from the user to the Internet.
VC	Virtual Circuit A connection from your ADSL router to your ISP.
VCI	Virtual Circuit Identifier Together with the Virtual Path Identifier (VPI), the VCI uniquely identifies a VC. Your ISP will tell you the VCI for each VC they provide. *See also VC*.
VPI	Virtual Path Identifier Together with the Virtual Circuit Identifier (VCI), the VPI uniquely identifies a VC. Your ISP will tell you the VPI for each VC they provide. *See also VC*.
WAN	Wide Area Network Any network spread over a large geographical area, such as a country or continent. With respect to the ATU-R110, WAN refers to the Internet.
Web browser	A software program that uses Hyper-Text Transfer Protocol (HTTP) to download information from (and also upload to) web sites, and displays the information, which may consist of text, graphic images, audio, or video, to the user. Web browsers use Hyper-Text Transfer Protocol (HTTP). Popular web browsers include Netscape Navigator and Microsoft Internet Explorer. *See also HTTP, web site, WWW*.
Web page	A web site file typically containing text, graphics and hyperlinks (cross-references) to the other pages on that web site, as well as to pages on other web sites. When a user accesses a web site, the first page that is displayed is called the *home page*. *See also hyperlink, web site*.
Web site	A computer on the Internet that distributes information to (and gets information from) remote users through web browsers. A web site typically consists of web pages that contain text, graphics, and hyperlinks. *See also hyperlink, web page*.
WWW	World Wide Web Also called *(the) Web.* Collective term for all web sites anywhere in the world that can be accessed via the Internet.